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Electrical Progress in the U.S.A.

THE new-year issue of the *Electrical World*, which reached our hands last week, is, as usual, of exceptional interest; nowhere else can be found such a wealth of statistical information regarding the electrical industries of a great nation—one which, from the point of view of electrical development, is easily first in the world. The Editors, however, utter a timely word of warning with regard to the use of statistics; accurate though these be, they may lead to erroneous deductions if not interpreted with intelligence and understanding. No better example of this truth could be found than the manner in which statistics were handled by the Weir Committee, and by the advocates of the Electricity Bill of 1926, during its passage through Parliament, as we demonstrated at the time.

It is interesting to note that the electricity supply industry of the United States, in spite of the advanced stage of development which it has attained, is confronted by problems similar in kind if not in magnitude to those which face us at home. Foremost is the problem of distribution: "the waiting market for electricity in industry and in commercial use is still vast," but it presents no real difficulty; "the more complex problem lies in the homes of the 17,590,000 customers now connected and *using the service in so pitiably small a way*" (our italics). To remedy this lack of appreciation four necessities are outlined—in brief, the creation of public interest, the provision of *adequate* house wiring, the more efficient selling of appliances, and the fixing of attractive rates—precisely what we need here also.

However, we have a long way to go before we shall stand level with the United States in the application of electricity. Last year the total output was 75,116 million kWh, about nine times our output with three times the population; 40 per cent. of this was produced by water-power, and nearly 20 per cent. of the total appears under the head of energy losses. The United States wastes nearly twice as much electricity as we generate! The gross revenue from the sale of energy

was $1,783,700,000 (say £367,000,000), and it is significant that of this amount $1,075,800,000 was paid by "lighting customers," and about half as much by "power customers." The average price obtained was apparently about 1½d. a kWh, but allowance must be made for the difference in purchasing power of money in that country, which would make the price equivalent to something less than 1d. here. The average consumption of energy for domestic purposes was only 1 kWh per day per house supplied, at 3¼d. per kWh. The plant installed in generating stations had an aggregate capacity of nearly 29 million kVA, and in 1927, 760 million dollars (156 million pounds) was spent on new plant, the total capital invested in the electricity supply industry being over 8,000 million dollars. There are no fewer than 4,409 supply undertakings in operation, with 21,700,000 customers. The average annual increase in energy generated in the United States is about equal to the total annual output of British authorised undertakings, and the annual consumption per head is now about 500 kWh.

One of the most noteworthy features of American practice is the extent to which customers are financially interested in the supply undertakings, which are almost wholly company owned. During the past year 3½ million shares were sold to customers and employés, valued at 240 million dollars; the number of shareholders in these classes is estimated at 1,800,000. Nearly two-thirds of the homes in the country are supplied with electricity, mainly for lighting.

In comparing United States with British data, it must be borne in mind that in this country the amount of electricity generated in private power stations for industrial purposes bears a considerable proportion to that generated by public authorities. It has been estimated at 4,000 million kWh. In the United States, on the other hand, industry is "75 per cent. electrified," mainly from public supply systems. The disproportion between the data will be materially lessened if these facts are taken into account; but unfortunately, no reliable statistics regarding the actual output of private stations are available for this country.

An Unlucky Enterprise.

THE exhaustive report of Messrs. Handcock & Dykes on the electricity undertaking of the Blackburn Corporation, which was briefly abstracted in our "Lighting and Power Notes" recently, draws attention to some of the disadvantages of placing the conduct of so highly specialised a business in the hands of a committee of untrained men, elected on political grounds and liable to changes of personnel at every election. The situation at Blackburn is particularly conducive to inefficiency and ineptitude of administration, for, according to the Report, the Electricity Committee comprises no fewer than 22 members, and the time allotted to its meetings is *only fifteen minutes per month!* And this in the case of an undertaking with an outstanding capital of 1¼ millions sterling! Obviously, under such conditions the Committee has a merely nominal existence, and can exercise no effective control over the business.

The consulting engineers recommend the appointment of a small committee with full executive powers, an arrangement which has worked well elsewhere; certainly it would be vastly preferable to the existing system, which is the limit of absurdity, but whether it would be practicable in a place like Blackburn, hag-ridden with politics, is open to question. However, it is clear that a radical reform of the method of administration is urgently called for.

As for the undertaking itself, it appears to have been singularly unfortunate in the play of events. Had the plant been extended when, in 1912, the borough electrical engineer, Mr. P. P. Wheelwright, reported that extensions were imperatively necessary, all might have been well—but before that step had been taken the war came, and it was not until 1918 that the corporation applied for sanction to a loan of £115,000, though the plant was fully loaded. By the end of 1918, 60 consumers were awaiting connection, and so many more were seeking a supply that a new application was made, more than doubling the amount of the loan. It was not until 1920 that work was commenced, and by that time the plans had been developed in view of the prospect of interconnection with other towns, and the expectation of an industrial boom, to such an extent that the actual cost of the work, completed in 1921, was over £800,000! Why so large an increase occurred is not clear to the consulting engineers, who point out that the outlay amounted to £42 10s. per kW installed, with no stand-by—but connection has now been established with Preston, enabling the full output of 20,000 kW to be given if called for. Unfortunately, it is not wanted, owing to the severe depression in the textile and other local industries. Thus Blackburn is saddled with an undertaking far larger than it requires, paid for at the top of the price curve, and deprived of the load which there was good reason to expect when the work was begun. Naturally the capital charges are inordinately heavy and have brought about large deficits in the last two years.

However, there is a brighter side to the picture. The Whitebirk plant is declared to be highly efficient and well managed, eminently suitable for inclusion in the scheme which the Electricity Commissioners are preparing for Lancashire; by further extending it to 50,000 kW or more, at present prices, the capital charges can be brought down to a reasonable figure, and it is hoped that the Central Electricity Board will accept it as a "selected station," when it can, of course, be economically loaded. Joint working with Preston will help towards economy, and the factory load will develop when trade revives. In the meantime the consulting engineers recommend that every effort be made to increase the domestic load, which the department is already fostering. We have seen other instances where extensions have been decried as excessive, and we have seen them quickly absorbed by the load and further extensions called for. We have no doubt that, whilst the situation at the moment is difficult, in the course of two or three years a similar result will ensue—and in the meantime Blackburn should overhaul its organisation and endeavour to place the administration of its electricity department on a sound basis.

Ready for The Fair.

BEFORE the present month ends the British Industries Fair for which greater efforts than ever have been made, and with prospects of greater success than on any previous occasion, will almost have run its course. It opens in both London and Birmingham on Monday, February 20th, and closes on the following Friday week. We have said so much about its electrical side during the past few months that there is little to add here at the moment, beyond repeating the statement that at both places the electrical features will be more numerous, more extensive and more impressive than they were either last year or in 1926, when the electrical section at Castle Bromwich entered upon its new lease of life. Eighty representative electrical manufacturing firms and companies are, according to official information, taking part at Birmingham, and in many cases they have booked larger spaces than before. The procedure of the last two years is being followed with reference to the programme of electrical visits of inspection and luncheons. It has been resolved in advance that the speeches at these luncheons shall be brief. We hope it will prove to be possible to carry out this good intention, and that the speeches will contain the right matter, so that electrical visitors will both have plenty of time to see the exhibits and to hear from the authorities information which will make their inspection profitable. Mr. H. H. Berry is the chairman of the Electrical Committee with Mr. T.

R. Martin, who has done so much in previous years, as vice-chairman. Mr. E. J. Jennings is once again filling the arduous position of honorary secretary. We wonder whether the industry recognises what it owes to several of these Birmingham gentlemen.

The central event of the opening day will be the Government Banquet at the Mansion House on the evening of January 20th, when many foreign guests of distinction will be present to hear a speech by the Duke of York. The special electrical days at Birmingham will be Friday and Saturday, February 24th and 25th, and Thursday, March 1st. On each of these three days, as already announced in the ELECTRICAL REVIEW, groups of electrical and allied associations will be present, and Thursday 23rd, will be women's electrical day. Their Majesties the King and Queen will honour the Birmingham Section with a visit on this occasion.

Mr. Vyle, of the Chambers of Commerce, in his broadcast speech last week gave an interesting and business-like account of the progress of the Fair movement. In the brief time at his disposal he was able to indicate that in his own firm's experience and in that of many whom he knew, the business obtained at the Fair had been very large indeed. He had no time to mention that electrical interests were now largely represented, but he showed that last year some Fair exhibitors booked orders enough during the run to keep them going for twelve months; he wished all 1928 exhibitors success, and invited firms who were not yet exhibiting to visit the Fair this year, see what was happening, and put their names down on the waiting list that has already begun for the 1929 display. It is officially stated that buyers are coming from 67 countries, a record number; they include Holland, the United States, Canada, France, Switzerland, Italy, Belgium and India, and from West Germany a party of 70.

We urge our readers to make their arrangements for visiting the Fair without a moment's delay.

Problems in Illuminating Engineering.

THE meeting of the Illuminating Engineering Society on January 24th, at which several interesting problems in illuminating engineering were discussed, was held under a cloud—for it was actually the first meeting held by the Society from which its founder and hon. secretary, the late Mr. Leon Gaster, was absent. Allusion was made by the president to the sudden death of Mr. Gaster on January 9th and a resolution was passed expressing deep regret at the great loss sustained by the Society and appreciation of Mr. Gaster's inestimable services to illuminating engineering. It will, indeed, be difficult to visualise the Society without Mr. Gaster, to whose invincible optimism and perseverance its success has been so largely due. We hope and believe, however, that its enduring success is now ensured and, as the president remarked, the best tribute to Mr. Gaster's memory that members can render is to devote themselves to its welfare. We are particularly glad to observe that the council has selected Mr. J. S. Dow, whose name has been linked with that of Mr. Gaster in this work from its very commencement, to carry on as honorary secretary. The first meeting held under the new conditions, which is referred to elsewhere in this issue, led to an interesting discussion, a variety of problems being dealt with by different speakers. Such discussions have a reassuring effect—for they show that there are now many workers in the field of illuminating engineering able to analyse its problems and to suggest methods by which they can be solved.

Fill up the Valleys.

IMPROVEMENT of the load factor is a problem that has engaged the serious attention of electricity supply engineers since the earliest days. All manner of schemes have from time to time cropped up for improving the load factor and increasing the useful service of the generating plant—from special tariffs for heating and power to national linking-up schemes—but so far the load curves show little improvement.

One promising solution to the problem is that which embodies some sort of storage system in which energy is accumulated during the "non-utility" hours.

An interesting proposal for this purpose is the "Change-circuit" scheme of Mr. Geo. Wilkinson, of Harrogate, to which reference has been made at various times in our columns during its evolutionary stages. The latest development is the application of regulating apparatus designed by the English Electric Co., Ltd., which was described in our last issue, so as to automatically control a thermal-storage load and keep it within the limits demanded by the ordinary load curve.

The idea is sound, and its practicability rests only on economic considerations relative to the capital costs of the additional apparatus and mains required. The figures given for a particular scheme are encouraging, and if a similar case can be made out in all or most instances the future of the system would seem to be assured. Furthermore, it has been brought home to Mr. Wilkinson by experiment that the heating apparatus required with the "Change-circuit" system is greatly reduced in size as compared with the equipment necessary for the same duty and supplied with "night" current exclusively.

Of course, the success of the scheme is bound up with the creation of a "storage" demand, but at 0.33d. per kWh, this should not prove difficult.

Distribution of Heat.

FROM time to time proposals are put forward for the utilisation of the heat energy which at present, unfortunately, is necessarily thrown away by almost every steam power station, the only exceptions being those which are associated with works using heat for industrial processes. So long as two-thirds of the heat contained in the fuel is thus wasted, electricity supply will not only have to bear the cost but will labour under a reproach which stings the conscience of every electrical engineer who loves his profession.

It is therefore interesting to learn, from the *Génie Civil*, that the municipal authorities of Paris have given their sanction to a concession for the distribution of heat in the City, taking effect from January 1st, 1928. The company concerned will supply heat by means of steam at a pressure of from 40 to 55 lb. per sq. in., through steel pipes, the water of condensation returning to the source. At first an old power station of the Metropolitan Railway will be used to generate steam to serve the eastern district; this will provide an output of 300,000 lb. of steam per hour. Later, the mains can be coupled up to the modern power stations at St. Ouen and Issy-les-Moulineaux, where the full capacity of the boilers is used only for a short time daily. Other sources of heat are also mentioned, such as refuse destructors and gas works. According to the terms of the concession, the company must have a minimum capital of 20 million francs, and will be given a monopoly up to the end of 1935, which will be maintained for the duration of the concession (40 years) in streets where the mains have been laid; the City will receive a share of the profits. The temperature of hot water delivered to the consumer is not to be less than 60 deg. C., and the pressure of steam must be at least 1½ lb. per sq. in.

It will be observed that this particular project, whilst it improves the utilisation factor of boiler plant in power stations and makes use of boilers that would otherwise be scrapped, does not touch the question of heat carried away by condensing water; it does, however, indicate that the supply of heat from central stations is a live question in Europe. More than 500 towns in the United States and Canada have heat supply systems in operation, and in several German towns such systems have been installed since the war, usually in conjunction with electricity supply, using either exhaust steam or steam bled from turbines.

Railway Electrification in India.

Inauguration of the Bombay, Baroda, and Central India Railway Co.'s Suburban Lines.

ANOTHER step forward in the electrification of the Indian railways* was marked by the opening on January 5th of the electrified suburban lines of the Bombay, Baroda, and Central India Railway Co., the ceremony being performed by the Governor of Bombay, Sir Leslie Wilson. The district served by electric trains extends from Borivli in the north to Colaba in the south, a total of some 57 track miles, and for the main part involves two lines only, the up and down locals, although between Grant Road and Mahim stations all four tracks have been electrified.

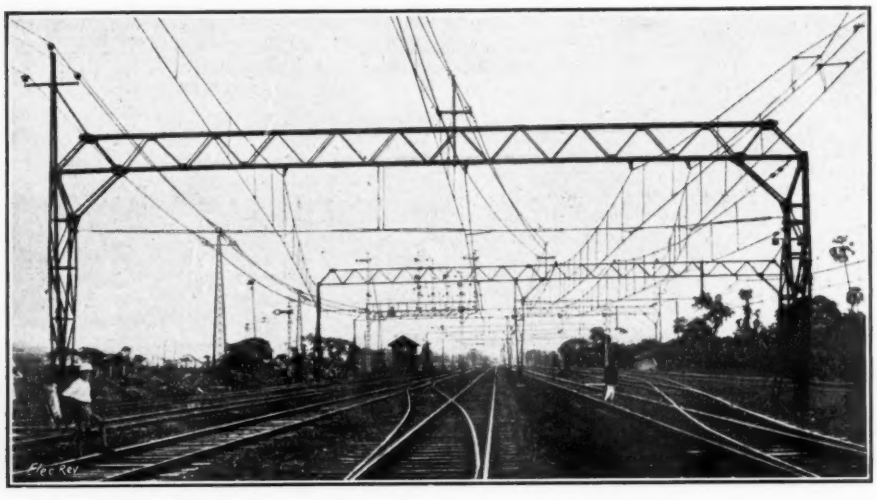


Fig. 1.—Track Equipment and 22-kV Transmission Line.

Electrical energy generated by the Tata hydro-electric, three-phase, 50-cycle stations is transmitted to a receiving station in the vicinity of Bombay at 100,000 volts and retransmitted at 22,000 volts between phases to the sub-stations, which convert it into direct current at 1,500 volts, and it is then fed into the track overhead system. A supply of 3-phase, 22,000-volt, 50-cycle energy is furnished to sub-stations for power purposes, the transmission lines being supported on extensions of the steel structures (fig. 1) supporting the traction line equipment; in addition, for station-lighting and signalling purposes, a subsidiary supply of 3-phase energy at 2,200 volts between phases and 50 cycles is distributed to stations between Santa Cruz and Borivli by lines carried as mentioned above, except south of Santa Cruz, where they are underground cables.

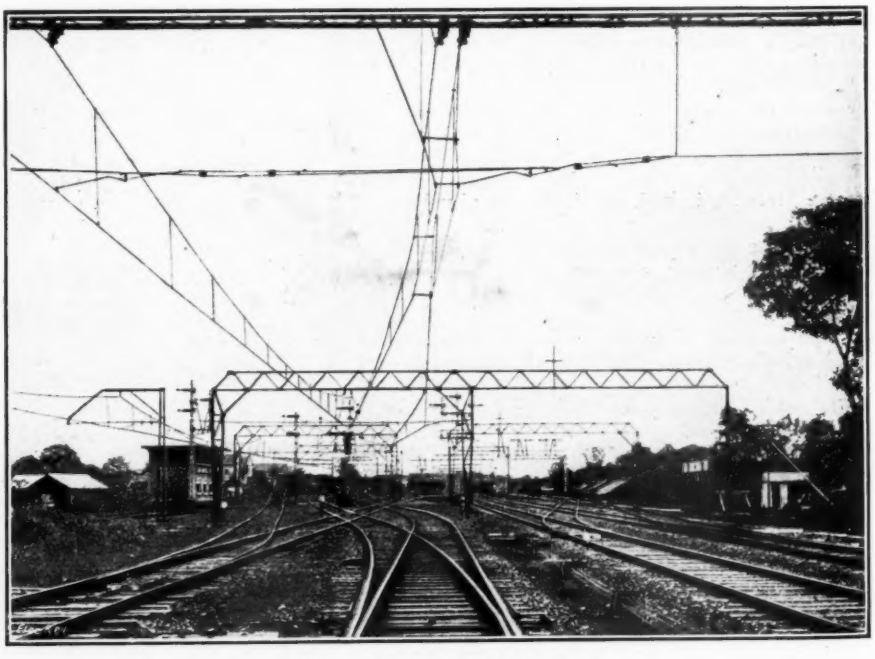


Fig. 2.—South End of Borivli Yard.

The traction line equipment follows normal practice and consists of an overhead contact wire of 0.25 sq. in. sectional area, supported by droppers at intervals from a stranded copper catenary of 0.375 sq. in., giving an area of 0.625 sq. in. per track; the cable, in turn, is suspended with double insulators from steel structures spaced normally 220 ft. apart, the return circuits being *via* the bonded track rails.

The lattice steelwork was so designed that equipment for all tracks spanned can be supported in the event of remaining lines being electrified at some later date. The catenary is supported at each structure by a two-disk suspension insulator of special design, which, in turn, is bolted to a movable plate attached to the lower boom of the bridge girder by hook bolts; this arrangement enables the overhead wires to be easily moved across the tracks in either direction in the event of a breakdown, thereby leaving room for the operation of a crane. The catenary, when fully loaded with contact wire and droppers, sags 6 ft. at 85 deg. F. with no wind and a span of 220 ft. In each span a 0.15 sq. in. flexible copper bond between the catenary and contact wire prevents current flowing through the droppers, and all fittings in direct contact with live equipment are made of gunmetal containing

* See ELEC. REV., Feb. 13th, 1925, p. 260.

80 per cent. copper. The contact wire is 17 ft. 6 in. above rail level and is staggered 9 in. alternately to each side of the track at structure positions to prevent concentrated wear of the pantograph.

Every mile of equipment is rigidly anchored, two structures being used for this purpose, and at these points catenary and contact-wire adjusting links are provided; these overlap spans isolate each mile of equipment in the event of mechanical failure, and the system is also sectionalised electrically at certain overlap positions by rapid-action air-break switches mounted on extensions of the steel structures and operated from the ground level by hand. To guard against nesting birds creating short circuits, the system has been provided throughout with special insulation, cross-arms and the like being protected by impregnated teak planks supported on porcelain troughs and connections of "Ancalite" insulated cable.

On single tracks, cantilever structures with extension brackets carry the cross-span construction; on curved track, pull-off masts erected in mid-span positions register the contact wire over the centres of tracks; sidings are equipped with a steel catenary in place of copper, the other equipment being the same as for running tracks. An example of the special means adopted for carrying the overhead equipment beneath low overbridges is the termination of the catenary on each side of the bridge on end-strain insulators and bonding it by means of 0.375 sq. in. "Ancalite" cable carried underneath; the contact wire is suspended by small single-loop droppers from a 1-in. diameter steel tube running the whole width of the bridge and insulated by means of inverted pedestal insulators adapted for attachment to steel channels on the under side of the bridge.

Approximately 2,000 tons of steel and 500 tons of copper were used for the overhead equipment alone, and the total tonnage of 22,000-volt underground cable supplied and laid was 720 tons; all wire, with the exception of the steel catenary, which has a breaking stress of 50 tons per sq. in., was hard drawn, having a breaking stress of 24 tons per sq. in. The accompanying illustrations show various types of equipment during erection: fig. 1 is a view of the Andheri yard, showing under- and over-hung catenaries at the entrance to the "stabling" sidings, and also 22-kV transmission line; fig. 2 indicates the method of registering and "knuckling" the contact wire at the Borivli yard.

The contract for both overhead equipment and underground cable was carried out by Callender's Cable and Construction Co., Ltd., to the specification of Messrs. Merz & McLellan, consulting engineers.

A Pier Electrical Installation.

Some notes concerning the equipment of the new Canadian Pacific Steamship Company's Pier at Vancouver.

By FREDERICK H. FULLERTON.

WHAT is considered in some quarters to be the finest electrical equipment to be found on any pier in the world is that installed on the recently opened pier of the Canadian Pacific Steamship Company at Vancouver, from which the Empress liners sail from Vancouver to the Orient.

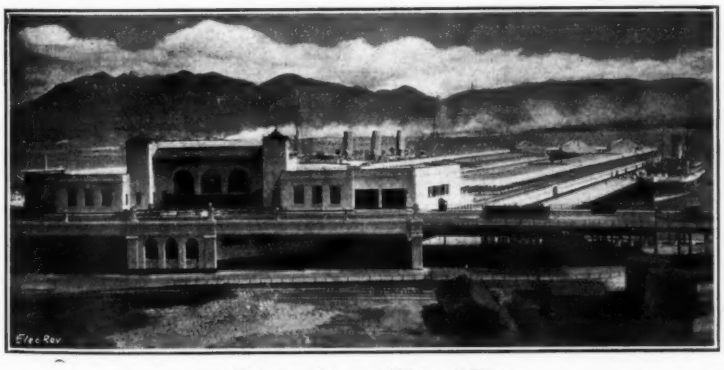


Fig. 1.—General View of Pier.

The pier, fig. 1, which was erected at a cost of over $1,000,000, is 1,300 ft. long and 340 ft. wide, and due, it is claimed, to the excellent facilities afforded, new records have already been established for berthing times.

Briefly, the construction of the pier is as follows:—There are two decks. Two lines of freight sheds run lengthwise along the pier, bordered on the outside by loading and unloading wharves, and separated by a central railway-track avenue. Each shed, fig. 2, has a 50-ft. centre driveway with a 20-ft. low-roof bay on either side.

Realising the important part that lighting plays in the efficiency obtained in the handling of goods, the owners and contractors set out to secure the very best lighting fixtures possible. A string of 100-W lamps in standard industrial reflectors, spaced 20 ft. apart, is arranged down the centre of the driveway, and in each of the bays a similar line of lamps, but in angle reflectors, is mounted, the lamps being placed over the doorways leading to the wharves or railway track. Local lighting is provided for in the bays by 300-W lamps in standard reflectors. Near the doorways, at 40-ft. centres, are plug points which serve for portable lighting fittings.

For the wharves and other outside areas special wall-type reflectors are mounted on the exteriors of the sheds. These are spaced 20 ft. apart, and are so arranged that every fourth lamp is on the "minimum" illumination circuit.

The front of the pier is lit sufficiently to make it stand out distinctly against the dark background of the harbour and mountains, and in order to prevent the street lamps on the approaches from distracting

Fig. 2.—One of the Freight Sheds.

attention from the pier, they are placed only on the south side of the viaduct approach in front of the buildings, and are shaded so as to allow as little light as possible to show towards the south. Flood-lighting is employed wherever possible for the exterior illumination. The railway tracks are lit only when in use, and for this purpose ten flood-lights, arranged in two batteries, are mounted at the ends of the area, and controlled from three different points. A huge electric sign at the north end of the pier bears the words "Canadian Pacific."

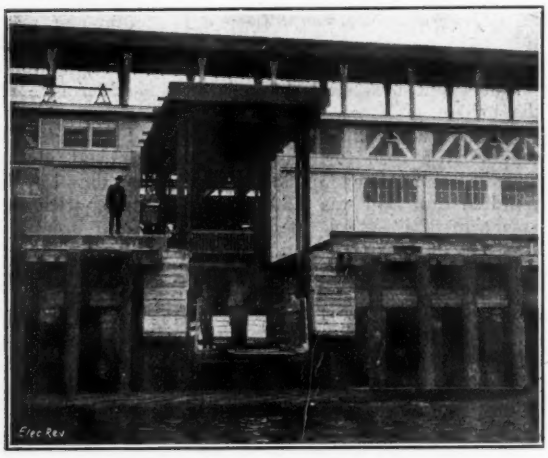


Fig. 3.—Marine Elevator.

A considerable amount of energy is used on the pier for power purposes, elevators, cranes, pumps, and so on being electrically driven. The cargo cranes are supplied from three-phase overhead systems, concealed and protected by the shed-roof overhangs, and extending for about 1,000 ft. along both the east and west wharves. Each trolley system is fed from two distinct sources, and split up by means of sectionalising switches. Tappings from the overhead lines serve for the other apparatus on the pier.

The electric brake on the marine elevator, fig. 3, is a feature of interest. It holds the elevator platform when at rest, is spring operated, and has to be released to start the machinery. When the power for the elevator motor is switched on, a small motor compresses the spring sufficiently to release the brake. It then stalls and holds the spring compressed until the power goes off, when the released spring backs up the motor and sets the brake.

The transformers and l.p. switchgear are housed under the lower deck of the pier in two concrete vaults. At extreme tides the height reached is three feet above the floor level, but there has so far been no indication of a leak. Each sub-station has two rooms; a large one, fig. 4, contains the transformers and h.p. switchgear, and the smaller one houses the l.p. equipment. The south transformer station houses three 100-kVA, 2,200- to 550-V transformers for the power supply, and three 75-kVA, 2,200- to 220/110-V lighting transformers, and a 1-kVA auxiliary vault-lighting transformer directly connected to the h.p. bus-bars. The other sub-station is similarly equipped except that the lighting transformers are of 50-kVA capacity. The north vault is supplied from the 2,300-volt bus-bars in the Canadian Pacific Railway depôt, while the other is fed from the h.p. cables of the British Columbia Electric Railway Company.

A feature of the equipment is a tower clock which is controlled by a master clock in the yard-master's office. A complete telephone system is provided for by a 100-pair main telephone cable from the railway depôt switchboard, and 25-pair laterals for distribution through the sheds and offices and to the wharves for six ship telephone connections.

Fig. 4.—Transformer and H.P. Switch Room.

Unemployment in 1927.

A review of the conditions in British Industry, showing the favourable situation of the electrical trade.

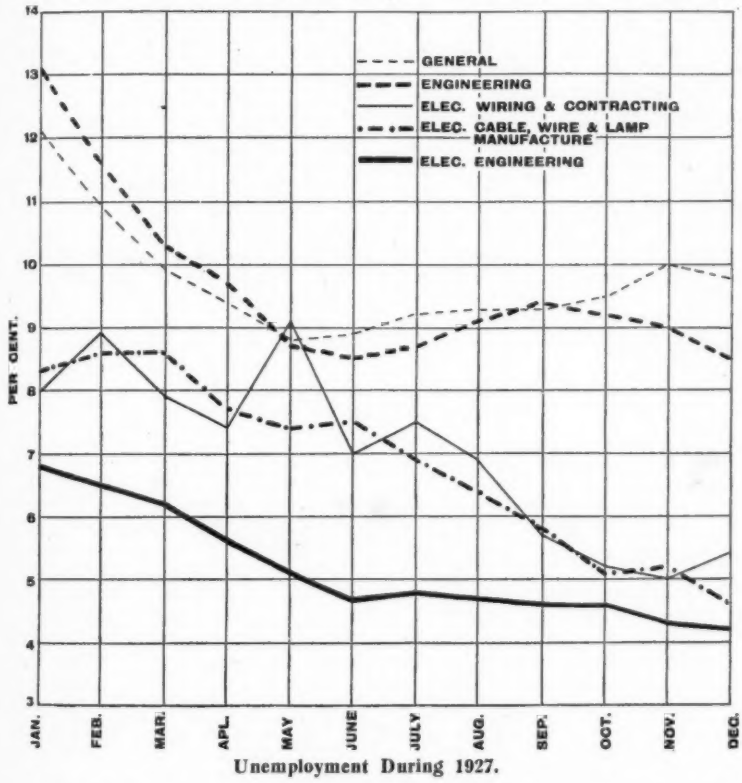
IN our issue of February 4th, 1927, we made a survey of unemployment in Great Britain and Northern Ireland, and produced curves illustrating the fluctuations which occurred during the year. The general strike and the prolonged coal dispute created a very serious position for British industry but, as our curves showed, the sections concerned with the production of electrical goods were, comparatively, far better placed than most other branches.

The curves which accompany these notes show a continuance of these favourable circumstances. At the same time, the principal fact which emerges from the curves is the gradual decline of unemployment generally and in all the industries dealt with. Taking the curve representing the total unemployment figures, it will be seen that it commenced at 12 per cent. and fell rather quickly to below 9 per cent. in May, thereafter gently rising to 10 per cent. with a slight falling-off in December. Since the close of the year there has been one large decrease and two increases in the weekly figures.

During 1926, the curve for the engineering industry as a whole remained consistently above that illustrating general unemployment. At one time it was almost

17 per cent., although in April it had been 10.5 per cent. Last year the two curves ran very closely together and during the last seven months the percentage of unemployed in the engineering industry was below the general figure, except in September, when it rose a trifle above. In June and December it fell to 10.5 per cent., which, as we have pointed out, was the lowest point of 1926. The tendency at the end of the year was towards further improvement.

The curve for electrical engineering is a satisfactory



Unemployment During 1927.

one, as it indicates a steady improvement. Except for a very slight rise in July, when, incidentally, electrical exports were at a low level, the decrease of unemployment was continuous, and by the end of the year the actual decrease in unemployment amounted to over 30 per cent. as compared with December, 1926.

The electric cable, wire and lamp manufacturing industries which are grouped together by the Ministry of Labour (upon whose returns these notes are based) are numerically greater than the electrical engineering industry. Here, again, a steady downward movement took place during 1927, broken only by negligible rises. The total decrease of unemployment during the year was greater than in the case of the electrical engineering class, amounting to about 35 per cent. between December, 1926, and December, 1927.

Although seasonal fluctuations were very marked in the case of the electrical wiring and contracting industry, the tendency was the same—very definitely downward. Between July and November there appears to have been considerable activity in the installation business. It has to be borne in mind that work in the engineering and heavy-products industries is spread over long periods, and lamps can be manufactured for stock. In the installation industry, however, the bulk of the work consists of jobs of small duration and fluctuations in activity are therefore reflected more rapidly and markedly. The curve compares very favourably with that for 1926, both in stability and tendency. In the preceding year 8 per cent. was the lowest unemployment level, but in the latter half of 1927 it was consistently below that figure.

To enable the reader to gauge the magnitude of the figures dealt with, as opposed to the proportion, we give the following particulars of the number of registered insured persons in the industries concerned, as at July, 1927, with the number of unemployed in December last shown in parenthesis: General, 12,131,000 (1,194,305); engineering (including electrical), 997,140 (84,964); electrical engineering, 79,300 (3,298); electric cable, wire and lamp manufacture, 84,510 (3,925); and electrical wiring and contracting, 14,810 (794).

In conclusion, it may be of interest to point out that the December *Ministry of Labour Gazette* shows that out of the 100 branches of industry specified, only 18 recorded a lower percentage of unemployment than electrical engineering, and practically all of these are concerned with the production of commodities and services in daily use by the mass of the people or are highly specialised trades.

Shoddy Wiring.

The author refers to the harm done to the electrical industry by bad installation work, discusses how the jerry wireman and shoddy work may be suppressed, exposes the weaknesses of the National Register of Electrical Installation Contractors, and urges better propaganda.

By H. R. TAUNTON.

(*Concluded from page* 141.)

THERE are at least three different forms which Government intervention might take, any of which would enormously strengthen the hands of *bona-fide* contractors in their fight against shoddy wiring.

The most obvious course, and the most direct, would be for the Government to adopt the Register. A Bill prohibiting installation work by any but a member of the N.R.E.I.C. would narrow our problem to that of weeding out the undesirables from the thronging applicants for registration. The position of the Executive would be so strong that it could afford to use its powers, far more drastically than is now perhaps advisable, to expel offenders against a code which could be as rigorous as the Executive cared to make it. In fact, it would be in the position of monopolists—and that is a position in which no modern Government is likely to place even so modest, disinterested and public-spirited a body of traders as are the members of our E.C.A. and N.R.E.I.C.! The academic arguments against

such a monopoly are themselves enough to kill any chance of legislation on these lines, so that it is superfluous to consider the many practical objections to it.

Another way of attaining our end would be a modification of that suggested by Mr. Edgar R. Morris in the January number of the *Electrical Contractor*. He proposes that it should be made illegal for anyone who is not "on, or employed by someone on, the Register" to handle wires or cables carrying (or intended to carry) more than, say, 20 volts. As it stands, this is no other than the proposal which we have reluctantly dismissed in our last paragraph as impracticable. If, however, we substitute for the words quoted, the words "a qualified person," we obtain a formula which, avoiding any suggestion of a ring or trust, might well prove acceptable to the powers that be. It would involve no more than a legalising of the obvious: that the technicalities of electrical work should no more be entrusted to an unqualified contractor than those of navigation to an unqualified seaman, or those of medicine to a quack.

The definition of "a qualified person" in the suggested Act would naturally include, specifically, members of the E.C.A. and the N.R.E.I.C., and their employés; and so, indirectly, we should have secured almost as much as we could have hoped to secure by official recognition of the Register exclusively. At the same time, legislation on the more general basis of "qualification" would, of course, permit the existence of firms and individuals outside the N.R.E.I.C.; but, to take the broad view, would that matter? Even if that body were presently found superfluous, would *that* really matter, so long as the jerry wireman was exterminated, and so the object with which it was founded was achieved? Indeed, almost certainly its membership would dwindle to the vanishing point, with the realisation that qualification under the suggested Act was the equivalent of present "registration." The N.R.E.I.C. would pass with its enemy, the cheap-jack; but those who have worked to make it a success would have the consolation of knowing that future generations would rise up and call them blessed, in that they first defined the status of the electrical contractor.

The third form which Government intervention in our problem might take is probably the best. It has the merits of simplicity and commonsense. All that would be necessary would be an Act recognising the I.E.E. Rules, and making it illegal for a supply company to connect up any installation not carried out in accordance with those rules. That would call for no elaborate machinery of Government inspection; it would simply throw the onus of maintaining the standard of electrical work on those most able to maintain it—the supply companies. Strictly administered—and a suitable penalty for negligence or evasion of the Act is implied—it would be the death blow of the shoddy man; and with his extinction, and the consequent reduction to a minimum of the number of faulty jobs, the working of the Act would involve the companies in no great difficulty or expense.

We have been promised a new and simplified edition of the Rules. If they were revised with that end in view—their ultimate legal adoption, and facile enforcement by the supply companies—it would bring that end so much the nearer. It is not an impossible end at which to aim. After all, to ask the Government to make compulsory some standard of domestic wiring is to ask no more for the householder and shopkeeper than the protection which the factory worker and the miner now enjoy. It is to ask no more than the removal of the anomaly by which the shoddy wireman flourishes: that it is nobody's business to enforce the standards which already exist to check him.

Such an Act would not, in its simplest form, cover the case of installations not dependent on a public supply, such as those of most country-houses at the present time. In the early future, however, with the wide extension of electrical networks, such cases will be relatively few. Moreover, shoddy work is not so commonly found in country-houses as to make it worth the complication of special legislation. We might reasonably expect, too, that once a higher standard of wiring were officially recognised, the fire insurance companies concerned would tighten up their inspections to conform with it.

So much for the possibilities of State assistance. If it can in any way be secured, it would open to us the easiest and most direct of the three avenues to salvation from shoddiness which we earlier defined. At present, however, it seems that on which we can least count; and since we cannot afford to lounge, twiddling our thumbs, at the corner of a "no-thoroughfare," it behoves us to follow the more vigorously the two avenues open to our unaided efforts, the second of which we have now to consider: to wit, the intensive education of the public.

Such education would obviously be unnecessary if the public were compelled by Act of Parliament to entrust their wiring work only to qualified hands. There would be no need to shepherd it from what would be then an impossible error. As it is, and as it probably will be for some time to come, unremitting propaganda is an essential, indeed *the* essential, the most effective weapon in our armoury. The vast majority of the jobs in which shoddy wiring may be looked for are placed by the public directly in the hands of contractors, and do not come until too late within the cognizance of any of the parties nominally associated with the Register. From that point of view the co-operation of, say, consultants and architects is of relatively little importance compared with the co-operation of the public. Of what use elaborate wiring rules, of what use the Register itself, however strong, if the public for whose benefit the whole has been designed is left ignorant of its existence? However strictly and completely we succeed in segregating goats from sheep, though we brand the one as "cheapjack" and "jerry wireman" and festoon the other with seals and certificates and garlands of righteousness, of what avail if the untaught public, unsuspicious of the cloven hoof—and wanting cheap wiring—is as likely to fancy a goat as a sheep?

All this is but to labour the obvious: if we are ever to abolish shoddy wiring, the public must be warned of its dangers and taught how to avoid them. A pity it is, that at this time of day anything in the nature of a "warning" in connection with matters electrical should be necessary. There is always the risk that by over-emphasis the ignorant may be led to associate danger with any form of wiring, so that in frightening them away from shoddiness we frighten them from any use of electricity. We must beware, then, of scaremongering, while at the same time contriving to convince the layman that we are justified in our insistence on the main end of our propaganda. That, of course, is to persuade him to employ only qualified contractors who can be trusted to give him a good wiring job.

The public is not easily taught. If we doubled the National Debt in the attempt, we could not in a generation make it understand the position as we see it. Technicalities would be wasted on it, generalities and abstractions simply bore it. The most we can hope for, is that by dint of constant hammering on a single, simple note we may in time evoke from its indifference the reaction we desire. It is no use, therefore, talking to it of wiring rules and standards of labour and material, of training and experience and commercial status, or any other of the vague and variable factors in a good wiring job. We must concentrate on one definite, easily understandable, easily recognisable essential which will cover all the others. We must say to the layman: "Look for this one thing, and all the rest will follow. You will be sure of a sound job"; and we must say it convincingly and all the time.

This one thing for which he must be taught to look, is obviously, as the case now stands, membership of the N.R.E.I.C. To make reservations, to drag in the E.C.A., for instance, is only to confuse the issue. If there are members of the E.C.A. who are not on the Register, that is to be deplored; but to tell the layman he may trust the one body equally with the other,

will only bewilder him unnecessarily. We cannot have two hall-marks, two slogans. We must confine ourselves to the one simple statement, unqualified and unvarying: "To be sure of safe, sound wiring, employ only Registered Contractors!"

Unfortunately, the training of the public in the way it should go is a long and costly process; and the question arises: who is to undertake it? Neither the N.R.E.I.C. nor the E.C.A. has the funds to embark on an effective publicity campaign, or even to repeat often the recent experiment in *Country Life*. Nor can we reasonably look to the E.D.A. to help us materially. The main motive of its existence is expressed in its title; and like the supply companies, it is more concerned in persuading the public to use electricity than in how they use it. At the same time, is it too much to ask—inasmuch as they are associated with the E.C.A. —that they should embody the N.R.E.I.C. slogan in their literature? It has been objected that that would be asking them to advise the public not to deal with certain traders to whom they themselves sell advertising literature: firms who are not, but might be on the register, and retailers who are not expected to be on it. But to ask the public to have their wiring work done by a registered contractor is not necessarily to ask them to buy their lamps and kettles from him. How, then, could the retailers object? And as for the unregistered contractors, who might object, their remedy is obvious: let them join the N.R.E.I.C.

Failing Press publicity, how are we to reach the public? By circulars, is the first and most obvious answer. For those, since for the moment the E.D.A. publications are useless for our purpose, we must look to the E.C.A. A simple folder would suffice, or even a leaflet, to be enclosed with every item of correspondence of every member of both the organisations concerned: something short and "snappy," well got-up, and varied from time to time, setting forth the arguments against shoddy wiring and for the registered contractor. The cost would be inconsiderable; so that, even if members proved unwilling to pay for their individual requirements, it might be possible to meet it from the common fund.

Circulars might be supplemented by posters for shop display; by suitably designed postcards for the use of members; by adhesive stamps bearing the essential slogan; by transfers for attachment to main switchgear (following the example of the old B.B.C. transfer) which would serve as the hall-mark of a "registered" job; by occasional inspired paragraphs in the non-technical press; in short, by a dozen inexpensive devices known to the publicity expert.

The whole problem of effectively educating the public is conditioned by the doubt as to how far zeal in the good cause will induce members to dip their hands in their pockets. Would they respond, for instance, to an appeal for subscriptions to a special fund for a widespread series of advertisements in general and local papers at reasonably frequent intervals? Failing that, could they be induced to embody permanently in their own local press displays the approved slogan of the N.R.E.I.C.? That is little enough to ask of them: it would involve them in no extra advertising costs, for it would only mean the sacrifice of a fraction of an inch of their usual space—surely the least value to be put on registration!

Only so; only by some sacrifice of time and trouble —yes, and even of money: only by the loyal and sustained effort, however small, of every true contractor, can we hope at last to win the fight against shoddy wiring and its perpetrators. . . . And, while we teach the public to "insist upon the trade mark—N.R.E.I.C.," let us ensure that it will never be dishonoured!

Mains Engineers' Problems.

The author reviews the question of service charges from the points of view of the supply undertaker, the contractor, and the consumer.

By DONALD P. SAYERS, B.Sc., A.M.I.E.E.

AN urgent need of electricity supply at the present time is great economy in the design of distribution systems, consistent with adequate provision for future development. Whilst the operations of the Central Electricity Board are directed chiefly towards cheapening the costs of generation, it is admitted that the anticipated reduction in the cost of the unit will still be governed locally, to a large extent, by the costs of distribution. Further, inasmuch as the development of the Board's programme will eventually relegate all but a small number of undertakings to the status of distributing agents, it follows that local supply authorities will have to concentrate in the future particularly on the problem of cheapening distribution costs.

The costs of ordinary domestic consumers' service cables represent a very considerable item in the total capital expended on the distribution system, and, moreover, these costs have increased very greatly in the last ten years as a result of the present-day practice of building widely spaced detached and semi-detached houses well back from the road, and also of the popularity of the scattered bungalow. Such developments may be highly desirable from most points of view, but the extra lengths of main required for electricity supply are tending materially to increase the distribution costs, and the question calls for the closest consideration of the mains engineer. In a typical middle-class street in a provincial town, built about the beginning of this century, the houses in a block have a frontage of from 16 to 18 feet each and are set back about the same distance from the footpath. In most cases one service cable of an average length of from 30 to 40 feet serves a pair of houses. The length of public distributor main required is, of course, 16-18 feet per house, excluding road crossings and occasional gaps. The figures for a typical row of modern bungalows occupied by much the same class of tenant are 60-70 feet of service cable for each bungalow, whilst the average frontage or length of distributor main per house is, at least, 40-60 feet, so that the total cost of distributor and service cables per house, in the latter case, is approximately three to four times the cost of the former. From these figures it is obvious that a line must be drawn somewhere between free services and those completely charged for. The mains engineer is constantly faced with the problem of where and how to draw this line. Whilst some undertakings have adopted a definite scale of charges, the majority still cling to the principle of providing free service connections wherever possible. The method of recovering the cost of excessively long services is thus largely left to the judgment of the mains engineer, who to-day finds that such services are becoming the rule rather than the exception. Whilst many cases can be dealt with more satisfactorily by individual treatment than by the application of a uniform rule or scale, the time is obviously overdue for the whole question of service costs and charges to be thoroughly examined on

economic and commercial grounds, with a view to placing them on a recognised business footing. In the first place, undertakings receive a great many applications from prospective consumers for whom considerable extensions of distributor mains are required, as distinct from service cables. In such cases ordinary service charges are not applicable and there may be influences other than economic considerations to affect the decisions as to the charges. The other factors in the situation may be :—

(1) Strategical; the proposed extension may supply a much-needed link to fit in with the rest of the network.

(2) Potential; local development may bring other new consumers on to the same main and so justify the capital expenditure at a later date.

(3) Political; the consumer concerned may have sufficient local influence to affect other residents in the neighbourhood.

The mains engineer is obliged to review all these factors bearing on the case before he can decide whether it will be in the interests of the undertaking to accept the application. In some cases it will be quite impossible to separate the various factors, and the decision then rests entirely upon the engineer's judgment and experience; in other cases he may be able to reduce the problem to a purely economic basis.

It may be useful to examine exactly what costs an undertaking is called upon to meet in respect of any single consumer's service installation.

The consumer agrees to pay a certain rate for electrical energy delivered to some point on his premises; against this the supply authority has to provide :—

(*a*) A capital sum in respect of the service cable, cut-outs, meters, and so on.

(*b*) The generation costs of the energy supplied.

(*c*) A certain proportion of the overhead charges on the generating station and main distribution system.

(*d*) Various maintenance costs such as the wages of meter readers.

With regard to (*a*) any capital outlay by a local authority can be considered as equivalent to an annual cost equal to from 8 to 10 per cent. of the capital, *i.e.*, 5 per cent interest charges and 3 per cent sinking fund. This item of cost can therefore be easily evaluated. There is also no difficulty in arriving at the cost of the energy supplied, provided that the consumer's annual consumption is known or can be estimated. Estimation in the case of domestic consumers is not easy, however, as the ratio of units consumed to the kW capacity of the apparatus installed varies enormously. As regards items (*c*) and (*d*) it is difficult to arrive at exact figures. Whilst the total costs in respect of the whole undertaking are always available, the difficulty is to determine what proportion of these costs should be assigned to any one consumer or one portion of the system. On the kW basis, if a consumer applies for x kW of apparatus, and the capital cost of the generating station is £y per kW of plant installed, the consumer may be regarded as responsible for a proportion of the annual overhead charges equal to :—

$$8\% \ (x/y),$$

and to be mathematically accurate this figure should be multiplied by the ratio :—

kW of generating plant installed/kW of all apparatus connected to distribution system.

Again, on the unit basis, if the overhead charges on the station are equivalent to A pence per unit distributed, which is supplied to the consumer at B pence per unit, the net return to the undertaking, after providing for the overhead charges, is obviously (B − A) pence per kWh.

It must be remembered that the overhead charges referred to here are only those charges in respect of the generating station and main transmission and distribution system, and should not include the charges in respect of service cables or plant installed for the benefit of any individual consumer. This analysis indicates that a service charge based on the true economic considerations would consist of two parts, one portion equal to or determined by the actual cost of the service connection, and one portion bearing no relation to the service costs but dependent upon the consumers kW demand and load factor. The price of the unit should then be adjusted to provide for the net cost of generation, and establishment and sundry maintenance costs.

General practice at the present time apparently ignores the first portion very largely and the second entirely, as service charges, and includes them under the net cost of generation. In other words no standing charge is made at all on service connections, but the cost is virtually met by an increase in the price of the unit. It is a rule of many undertakings to allow a certain length of service cable free, usually about 60 feet, or else charge the consumer a proportion only of the cost. In the author's opinion these methods are not economically sound and tend to keep up the cost of the unit. If every prospective consumer were called upon for a small standing charge which would vary slightly according to his prospective load, together with a further charge based on the service-connection costs, a lower tariff would ultimately become possible which would more than balance his initial outlay. It is a fairly general practice to make a small quarterly or annual charge in respect of any meters installed on the consumer's premises and in most cases this charge covers the cost of meter inspection and collection. It cannot be said, however, that there is any one basis of service charges in general use.

The following summary indicates briefly some of the different methods of making service charges which are used fairly generally :—

(*a*) The consumer may be asked to pay for his own service cable or a portion thereof. This is the simplest type of charge and is most generally used. The cost may be taken to include the bare cable and labour costs, or it may include 10 per cent establishment charges and a percentage profit. The basis of calculation may be :—1, on all work carried out on private property, 2, on all work carried out in excess of a certain maximum length or cost, or, 3, on a sliding scale of charge per foot depending on the amount of apparatus to be installed. On the other hand many cases occur in practice where this method is found to become an unduly heavy charge on the consumer with a very long service cable, or is not adequate for the supply authority when a long extension of distributor main is called for.

(*b*) In the latter case the consumer can be called upon to provide a rental charge. This is particularly useful in respect of a main which is likely to serve other consumers who may be connected at a later date. The rental charge can then be reduced by a pre-arranged amount and ultimately to zero as and when other consumers are connected. There is in this method a definite incentive for all possible residents in the immediate neighbourhood to become consumers.

The drawback is that the rental charge is liable to become perpetuated and the consumer will feel it is an unfair burden, particularly if the house changes hands; so that in the end the rental charge may either become a source of friction or else have to be relinquished.

(*c*) As a form of service charge the consumer may be asked to guarantee a certain minimum revenue for a stated period. This is a very fair method from the consumer's point of view and may be very profitable to the supply authority. The amount and period of the guarantee is calculated to cover the supply authority for all capital liability involved and at the same time the consumer is encouraged (one might even say coerced!) to use electricity for all possible purposes. This method is particularly applicable to industrial supplies where heavy capital costs may be involved in providing special sub-stations and h.p. cables and equipment. Considered as a service charge, the economic basis of this method becomes very involved.

(*d*) In the case of large power consumers, the current is generally supplied in bulk under a two-part tariff. Under this arrangement the fixed charge per kW of

maximum demand may be adjusted to take into account any special service charges, in addition to the general overhead charges of the undertaking. This is the most economically sound method of charging and has made great strides in popular favour in recent years. It is apparent that it cannot be applied to domestic consumers so long as they continue to be charged under a uniform tariff. The method is obviously not sufficient in itself without some sort of guaranteed minimum return.

One or other of these methods will generally be found to meet every situation. The mains engineer must be prepared to do a certain amount of bargaining and must bear patiently tedious correspondence and interviews with concession-hunting applicants. It makes an interesting study in human nature to observe how one method may be indignantly rejected by one individual and gratefully (more or less!) accepted by another. This is particularly striking when the alternatives are offered of an annual rental charge as against a lump sum down.

So much for the question of service charges from the point of view of the supply authority. Admittedly this article is written by a mains engineer, but he has endeavoured not to lose sight of the consumer's and contractor's points of view. Whilst these charges may be a hardship on many would-be consumers, and may act as a brake on the introduction of electricity into some classes of property, they are, in the writer's opinion, beneficial to the consumer in the long run. It is ultimately cheaper for the consumer to pay for relatively small capital charges out of his own pocket direct, than to leave them to load up the capital liability of the undertaking and emerge later in the more or less permanent guise of higher prices for electricity. Further, the adoption of a service charge immediately results in more economical work by builders and contractors. A little care on the part of the builder in providing accommodation for meters and cut-outs to be fixed at the nearest possible point to the distributing mains can effect great economies in service cables, whilst the labour costs of fixing the service may be appreciably reduced by providing, in the early stages of building, an easy entry through walls and foundations.

It is beyond the scope of this article to treat the question of service charges fully from every point of view. It serves to show, however, that the subject is very complex and is deeply involved with the question of tariffs and the economic basis of the supply industry generally. The treatment of this question by the many different undertakings in this country shows an extraordinary lack of uniformity. It might well be the subject of a full inquiry by some competent body such as the I.M.E.A. or the Electricity Commission, with a view to formulating some general policy capable of national application. In any case, it is to be hoped that the subject will be accorded greater publicity in the future, if only that a suspicious public may realise that the service charge will react to the benefit of the consumer, and that it is a step towards the cheapening of distribution costs.

National Insurance Cards.

The Employer's Duty.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

THE stamping of insurance cards is one of the penalties of modern civilisation. It is one of those irritating little duties thrust upon employers by a fatherly government whose supervision of industry is now so firmly established.

Pettifogging as the job may seem, the correct stamping of insurance cards is regarded as a serious duty by the law. So much so that cases have recently occurred in which fines amounting to £70 or more have been inflicted upon employers for failure to affix and cancel the proper stamps at the right time.

The penalties become heavy by reason of the fact that under the National Health Insurance Acts, failure each week to stamp a card is treated as a separate offence in respect of each employé concerned. Hence, if there are twenty employés and the cards are unstamped for three weeks, sixty offences will have been committed, each involving a penalty not exceeding £10.

Now very many employers do not stamp the cards each week. Some are in the habit of stamping them monthly or quarterly. In order to cancel the stamps the employer will then write his name or impress a rubber stamp across the whole line of stamps, cancelling the whole batch at once. This, of course, is quite irregular. Even if the employer lets the matter run on for a week or two before stamping the cards up-to-date, he should make a pretence of having stamped them each week, and consequently each stamp should be properly and separately cancelled with the date of each particular week for which the stamp is supposed to apply.

The duty, as laid down by the Courts, is for the employer to affix the stamps to the contributor's card before paying wages for the period to which the stamps apply. It is not sufficient for the employer, within six days after the period of currency of the card, to affix stamps for the whole period of its currency.

This rule was laid down some years ago in a case before the King's Bench Division. In that case the employer was in the habit of affixing no stamps at all to the card until the period of its currency had run out. Then he would stick on enough stamps to fill the card right up. During May—more than half way through the period a call was made by an insurance inspector, the card was found to be unstamped, and the employer was brought before the magistrates. The magistrates dismissed the charge, but on a case being stated to the High Court, the judges held that the practice of the employer was quite wrong. Cards should be stamped each week.

The position of an employer is not easy. He is permitted to delegate the duty of stamping the cards to an employé, but if the duty is not performed, it is the employer who will be liable. An employer will not be able to excuse himself by showing that he gave his secretary cash and instructions to buy the proper stamps.

It is not infrequent, especially in firms where there are very few employés, for the employer to hand over his contribution to the employé and tell him to stamp his own card. This may work satisfactorily in many instances, but if the employé should fail to buy his insurance stamp the employer will be answerable for the default.

Employers should make a point of looking through the insurance cards at frequent intervals to see whether the stamps are there. Such a course prevents any oversight or dishonesty on the part of the clerk whose duty it is to attend to the stamping of the cards.

There are some employers—they are few in number it is true—who are so careless as to the duty of stamping the cards that they fail to attend to it at all. They fondly imagine they will never be found out, but when it is realised that changes of staff and a bad turn in

trade may send an employé on to the unemployment "dole," or a sudden sickness may necessitate a claim for sick benefit, the omission of stamps from the card is bound to be discovered.

Besides the criminal penalties to which an employer may become liable for not stamping cards, he is also liable to the employé for any sick benefits which the employé may have lost through his card not having been stamped, and the employé will have this right to claim on his employer even though the failure was due to the employés' own neglect to buy and affix stamps.

The same applies to unemployment insurance. In addition to these liabilities the employer may become liable to pay all the contributions which are unpaid. Accordingly, where an employer has entrusted the duty of stamping the cards to a clerk, and the clerk fails in his duty, the employer will have to make good the failure of the clerk, even though the clerk may have received the money for the stamps from the employer. The same applies where the employé has been given the money to stamp his own card and fails to do so. The employer will have to pay up all over again as well as becoming answerable for the penalties and liabilities above-mentioned.

It will thus be seen that the business of attending to national insurance cards is not lightly to be regarded. Cases do not very often arise because of the difficulties of inspection, but when they do, the penalties imposed are likely to be very heavy.

Inspectors have wide powers to enter any place of business at any reasonable time and to make any examination either of books or of employés which may be necessary. The employer's duty is to furnish facilities to the inspector and any attempt at obstructing him in his duties is dealt with very severely.

Electrically-Driven Woodworking Machinery.

Some aspects of the direct electric drive, with special reference to the employment of high speed, which is made possible by the application of high-frequency alternating-current motors.

By "BATTEN."

THE direct-driving of machinery by electricity is always fascinating, perhaps more so in the case of woodworking machinery, first, because of the higher speeds which are used and, secondly, because high-speed belt-driven woodworking machines waste a tremendous lot of power in driving the belt, or belts, alone. Moreover, in woodworking establishments the bulkiness of the work going through the shops is greater than in most other trades, and therefore all available space that can be got is needed for stacking and the easy transport of the vast number of quickly-produced parts which go to make up cabinet and joinery work.

Naturally enough, in any advanced movement there is always a certain amount of scepticism, and it takes a long time to get rid of preconceived ideas. The first move was to employ what is usually alluded to as "the grouped drive," several machines being driven from a line shaft which, in turn, was belt-driven by a motor. The next step, which is that most in vogue at the present time, is to couple the motor to the countershaft of the machine, or, if only one, or perhaps two belts work very close together, to put a single or a double pulley on the extended rotor shaft and do away with the countershaft altogether; but this still means that belts are used.

Speed and Frequency.

The Central Electricity Board's declared intention of standardising frequency, as and when required, to facilitate its policy of centralising generation, may convey the impression that there is no virtue in any but the national standard of 50 cycles per second, but it so happens that a 50-cycle motor will only run at synchronous speeds of 3,000, 1,500, and 1,000 r.p.m. (and lower speeds which do not matter). Now 3,000 r.p.m. is often too low a speed for a direct drive, and others do not all fit in; for instance, while a 42-in. circular saw might be directly-coupled to a 1,000-r.p.m. motor, a 36-in. saw cannot be directly driven at 1,500 r.p.m. because that speed is too high, or at 1,000 r.p.m. because that is too low; again, 3,000 r.p.m. is too low a speed for most classes of planing machine. It is this sort of consideration that perpetuates the use of countershafting.

The American national standard frequency of 60 cycles would be much more convenient, and it is of interest to note that a great deal of the pioneer work in the direct coupling of electric motors to machinery spindles was done in the United States. The realisation of this fact is becoming apparent in Britain, and several firms are now offering more suitable plant; moreover, in cases of 60-, 75-, 100-, or 120-cycle machines being required they are also offering, as part of the equipment, frequency changers whereby the periodicity may be increased to the desired amount. It is, perhaps, rather futile to step up the frequency in small lots, but the fact that it is being done represents progress and the realisation of what beltless machines mean. It is a stepping stone for the woodworking shop, which will eventually change most of its electric power to 60 cycles, and a smaller amount to 100 cycles, in a power house of its own.

Standardisation of Motors.

There is also a tendency towards the standardisation of motors, and they are being made of the loose rotor and stator type by the more progressive manufacturers in different ranges, so that an odd rotor and stator may be kept in stock for use in case of breakdown, because the loss of a machine in a woodworking establishment usually throws the whole place out of gear.

Another thing which is of great interest in this new endeavour is the fact that the motors should preferably be, and they are being made, totally enclosed. Those who have never been in a woodworking shop, especially where hard wood is being worked, have no idea of the amount of dust and grit which is carried in the atmosphere, and it becomes really a necessity to totally-enclose the motors. Further, the carcase must be small in diameter.

Countershaft Driving.

With regard to driving by means of countershafting, some idea of what should be offered is afforded by the accompanying list of machines which are in everyday use in woodworking machine shops, with the probable countershaft speeds. It will be noticed that some of the machines have a one-hour rating, while others are continuously rated; this differentiation should be borne in mind, because in several instances there is no necessity for the customer to spend more money on purchasing a continuously-rated machine when an hourly-rated machine might fulfil his requirements.

The writer has no hesitation in saying that in a few years' time the idea of the direct drive will have got such a hold on people that it will be the exception to buy a machine with belts; one can to-day buy a woodworking machine, made in this country, which is driven by 10 separate built-in motors.

There is still, however, a fortune waiting for the man who can discover how to make 50 cycles do the work, electrically, of 60 or 75 cycles.

Machine.	Size.	Countershaft probable R.P.M.	H.P.	Rating.
Joiners' Tenoner ...	24" × 6"	960	7	Hour
Chain Mortiser ...	10" × 6"	1,460	3	Hour
Hand Planer ...	12"	1,460	2	Hour
Panel Planer ...	24"	960	12	Continuous
Edging Saw	4"	960	15	Continuous
Spindle Moulder ...	6"	1,460	3	Hour
Radial Arm Saw ...	36"	960	25	Continuous
Dovetailer	25-spindle	720	5	Hour
Drum Sander ..	42"	720	20	Continuous
Planing & Moulding Machine	12" × 6"	960	50	Continuous
Combination Planer	24"	960	7	Hour
Chisel Mortiser ..	1½" sq.	1,460	5	Hour
Double End Tenon Machine	6' 0" × 6"	960	20	Hour
Lathe	8"	720	2	Hour

As an illustration of the above contentions, reference may be made to an installation recently carried out at the newly erected furniture factory of Messrs. E. Gomme, at High Wycombe, Buckinghamshire. A steam engine and alternator of 350 h.p. have been provided: the power load is 224 kW, and the lighting 44 kW, at 220 volts, 3-phase, 60 cycles, and there is also a frequency changer for providing a 100-cycle supply, all controlled from a slate switchboard.

The majority of the factory machines are fitted with their own motors, built in and operated by push-button starters. A dust-extracting plant provided with two 30-h.p. motors removes the rubbish from the machines and conveys it to the stokehole. Throughout the entire works upwards of seven miles of cables have been installed, and there are 300 lighting points and 40 motors.

The work has been carried out by Mr. Edward H. Milner, of High Wycombe, and the electrical installation at the factory is in charge of Mr. George Milner.

Portable Electric Tools.

Mr. C. B. Coates recently drew attention to this subject by explaining in the *American Machinist* the advantages of driving portable tools by high-frequency motors of the 3-phase 2-pole induction type. The higher frequency allows the synchronous speed of the machines to be raised to 10,800 r.p.m. at no load and to 9,936 r.p.m. at full load, assuming an 8 per cent. slip, thus greatly increasing their power without increasing the size or weight of the rotors.

High-frequency motors are now used in portable tools for drilling, reaming, tapping, driving screws, tightening nuts, grinding, buffing, sanding, &c. Maintenance costs are low because of the absence of commutators and brushes, and because the squirrel-cage rotor cannot burn out, whilst the constant speed results in the drill bits, &c., being less frequently broken.

The selection of the best frequency was of importance, and 180 cycles per second has been chosen in America as providing the most satisfactory speed for the ball bearings used in portable tools, and as affording a greater margin of overload than obtains in the case of normal types of tools; moreover, being a multiple of 60 cycles, it can easily be produced by a motor-generator or frequency changer. If the former is used, the voltage can be controlled by varying the exciting current in the generator field. A frequency changer can only be operated from an a.c. source, no d.c. being involved, thus eliminating the exciter: if a 3-phase slip-ring induction motor has its rotor blocked so that it cannot revolve, and 60-cycle a.c. be applied to the stator, a transformer effect will result and 60-cycle a.c. can be taken from the slip rings. Assuming it to be an 8-pole machine with a normal speed of 900 r.p.m., if the rotor be driven in a direction opposite to that in which it would run as a motor, an additional frequency of 60 cycles per second will be produced, so that 120 cycles will be available at the collector rings; if the speed be doubled (1,800 r.p.m.), 120 cycles will be added to the 60 cycles of the line and give 180 cycles. The size of the motor required to drive this outfit will be 120/180, or two-thirds of the entire input required for the generator, as one-third of the power goes directly from the supply mains into the stator. The only saving effected is, of course, in the first cost of the motor; this type of frequency changer is being very successfully used, it being necessary, however, to design it for not more than 8 per cent. voltage regulation, and it is not possible to vary the voltage.

Tools of this character need an independent wiring system, and they have had to be provided with the greater gear reduction necessitated by the higher loaded speed of the rotor.

Refuse Fuels.

The utilisation of town's refuse and other so-called "waste fuels" for the production of steam wherewith to generate electricity.

(*Extracts from paper read before the* INSTITUTE OF FUEL.)

At a recent meeting of the Institute in London, Mr. Frank Hodges (chairman of the Council of the Institute and a member of the Central Electricity Board), who occupied the chair, said that the utilisation of refuse fuels had become of great public interest, particularly since the discussion of the wider development of electrical energy. The Central Electricity Board had had to face the subject since some authorities had been developing electrical energy from their towns' refuse, and claimed to have been utilising it economically. The problem of the utilisation of "waste" was important to those engaged in the gas, electrical, chemical and coal industries, and he was sure that all engineers were rapidly coming to the conclusion that there would have to be a radical review of the potentialities of most of the things they had to deal with, in order that so-called "waste" might be turned to economic advantage.

The Utilisation of Refuse.

By A. B. SCORER, A.M.I.E.E.

At the time when small electricity works were being established, steam provided by refuse destructors met a very considerable portion of the total requirements, but the fuel value of town's refuse has decreased, particularly in the summer months. An alternative system of treating town's refuse as a whole is to screen it and separate the various materials of which it is composed. The main consideration of such schemes is to find a permanent market for the salved materials at a paying price. If the Corporation concerned has a number of boilers under its control, such as at electricity works, &c., where a continuous outlet is provided for the cinders, a good balance sheet can be made out for the process. It has, however, to be borne in mind that an outlet must be provided for the dust. It seems that a scheme for burning the refuse in its entirety with full steam raising boilers would meet the conditions best. It is, of course, a laborious job to raise steam on cinders having a 20-per-cent. ash content, and considerable prejudice exists on the part of engineers and firemen against their use. There is, no doubt, however, that at a price of 5s. to 7s. 6d. per ton, with suitable furnaces, it is a paying proposition for the average steam user. The calorific value of a ton of unscreened refuse is 2,500-3,000 B.th.u. × 2,240, and, allowing 1½ lb. of

steam per lb. of refuse, this would give us 3,360 lb. of steam per ton of refuse. A modern turbine set produces a kWh for 15 lb. of steam, which equals 224 units per ton. These figures would, however, only be obtainable with the very largest plant, and not in the summer when the refuse is much poorer. If there is an ample use for the steam or electricity there is no doubt that a modern steam-raising plant will give the most profitable results; at the same time it is the most hygienic.

The plant installed at the Hackney electricity works is a good example of a destructor steam-raising plant. There are three "Meldrum" front-feed units, each with four grates, having a capacity of 216 tons daily. During last year 42,000 tons were destroyed, and, although the steam is not metered separately, it is valued by the Electricity Department at £3,000 per annum, and the clinker is sold for £2,200 per annum. The boilers have a heating surface of 2,852 sq. ft., with superheaters, and steam is generated at 250 lb. per sq. in. The evaporation per ton of refuse varies from about 60 in summer to 100 in winter. Better results would be obtained with rather larger boilers. At the Bury St. Edmunds electricity works the refuse is burnt direct in large water-tube boilers by means of the "Meldrum" forced-draught system. The amount of refuse consumed last year was approximately 4,250 tons, in addition to 2,654 tons of small coal and cinders. Since these furnaces were installed for dealing with the town's refuse the coal consumption has been reduced from 9.50 to 5.50 lb. per kWh, and since a new boiler was recently equipped with these furnaces it has been further reduced to 3.93 lb. This system of burning the refuse mixed with slack direct in water-tube boilers is quite the cheapest method of refuse disposal, provided a full use exists for the steam.

Apart from town's refuse there is a large amount of industrial waste which can be readily utilised. The collieries have been in the past great sinners in this respect. They have thrown away enormous quantities of fine fuels because they were difficult to burn, whereas with proper appliances they could easily have obtained a large supply of steam from them.

Discussion in London.

The CHAIRMAN, opening the discussion, said that it was important that such processes as had been dealt with in the paper should be developed in order to protect public health. Having satisfied themselves that that was the case, they might consider whether or not it was profitable. The various municipal authorities of London, for example, might find it difficult each to work its own separate destructor plant economically, but he suggested, as a possible line of future development, that in view of the fact that those authorities were contiguous one to the other, they might co-operate in the construction and working of a joint or corporate plant which, in addition to serving the interests of public health, could be operated economically.

Mr. ARTHUR GROUNDS asked what was the average blast pressure necessary for the satisfactory combustion of ordinary household refuse? The author had mentioned figures of 16 and 34 inches water-gauge pressure in some of the German plant where the shaft system had been adopted, but it appeared to him that with such high pressures there must be a serious possibility of a dust nuisance being created. The results obtained with the plant at Bury St. Edmunds, as mentioned in the paper, demonstrated that a refuse destructor could be a very economical and useful aid to municipal finance. Considering that it was an old station, apparently with reciprocating engines, quite a good reduction in fuel consumption had been made, and it was certainly a matter upon which to congratulate the suppliers of the refuse destructor.

Mr. STEPHEN N. WELLINGTON, who had seen in London recently the shaft-furnace plant erected by the Woodall-Duckham Company, burning 500 lb. per sq. ft. of grate area per hour, emphasised the importance of amalgamation and co-operation in the destruction of refuse; it was possible, with a well-designed furnace and equipment, on a large scale, to secure a thermal efficiency overall of 72 per cent. With refuse having a calorific value of between 4,000 and 5,000 B.th.u. per lb. With plant consuming 1,000 tons of refuse per day it was quite possible, using modern turbo-generators, to get down to 11,850 B.th.u. per kW, and the amount of energy developed from a ton of refuse could be as high as 454 kW-hours. Dust could be eliminated by means of cyclone extractors, by the cascade system, or by electrical precipitation. The provision of means by which to attain the high efficiency was, of course, rather costly, and could be considered only in large-scale practice.

Mr. A. W. JAMES, referring to the plant now nearing completion at Glasgow, said that it would deal with 500 tons per day at first, and later, with 1,000 tons per day, and there was a practical guarantee of 400 kWh per ton of refuse burned.

Mr. J. D. TROUP discussed the general trend of design for destructor work, and gathered that there was a tendency in favour of the shaft destructor.

Mr. ANSLOW said that the majority of the Scottish collieries burned all the refuse they could for the production of their own power, but still had a surplus which had to be thrown away because it had no saleable value. The fuel could be burned more economically on a larger scale, but it meant enormous capital expenditure and that was the difficulty of the comparatively small collieries. In addition to the power they obtained from their refuse, in many cases, they had also to buy electric power, because it did not pay them to use more refuse; a colliery load was a comparatively short one, and the load factor was small, so that it was very difficult to install plant of small size which would pay the capital charges. With regard to low-temperature carbonisation, he had had experience of a very efficient plant installed at a colliery in Scotland; the results obtained with it were extremely good, but it was on such a small scale that the labour and capital costs outweighed the other benefits obtained. As a result of the experience gained with it, however, a project was on foot for proceeding on a very much larger scale. He expressed quite definitely the opinion, based on comparative tests he had carried out recently, that wood refuse alone could be gasified and utilised in gas engines much more efficiently than it could be used in any type of boiler and steam engine; the thermal efficiency of the gas plant was very much greater.

Mr. C. H. MCCALE agreed that, when utilising wood refuse, a high thermal efficiency should be obtained by generating gas from it and utilising the gas in a gas engine.

Mr. A. B. SCORER, replying to the discussion, said that with the flat-grate furnace, which was practically univresal in this country, an air pressure of from 2 to 4 inches water gauge was quite sufficient to enable reasonable combustion to be attained in a really good-class of clinker. He knew of only one case in this country where gas producers were being used: that was at Halifax, he believed, where the system used was a very mixed one. They did not use the raw refuse, but screened the cinders from it and used them in a producer to obtain gas, then using gas-fired boilers to obtain power. He knew of no case in which gas was made direct from town's refuse. He agreed that in a large modern plant, where there was every possible facility available for air heating and the proper utilisation of heat, figures such as those given by Mr. James could be attained. As to the trend of design, the continuous grate was the basis of all modern destructors in this country, with the exception of the shaft furnace, which was not exactly a gas producer. The average calorific value of town's refuse varied from 2,500 to 3,000 B.th.u. per lb., but the figure varied according to whether the refuse was obtained in a colliery district, where many of the inhabitants used free coal, or in a country town in the south of England, where more gas fires were used.

Steam-Nozzle Research.

The fifth report of the Steam-Nozzles Research Committee, which was read before the Institution of Mechanical Engineers on January 20th, represents the beginning of a new phase in the work of the Committee; the scope of the research has been broadened by considerable additions to the original apparatus, and still further additions are in contemplation. Tests have been made on a nozzle under different conditions of pressure range from those which had been previously used. Instead of exhausting against the back pressure due to the atmosphere, the pressure in the receiver was maintained at approximately 60 lb. per sq. in., abs., and the initial pressure was adjusted to give velocities of the steam jet at the exit extending up to the velocity of sound in steam. The nozzles tested were convergent impulse ones with a nominal angle of 20 deg., and owing to the larger quantities of steam flowing their height was reduced from 2 to 1¼ in. Otherwise they were commercially similar to those previously tested against atmospheric back pressure. The efflux angles of the new nozzles were found to agree with those previously determined, and the same settings in the tester were used. The initial superheats in the new tests were adjusted to correspond with those of the old. This involved the use of higher initial steam temperatures owing to the increased steam pressure. The degree of accuracy of the new tests fell off at first, but the difficulty was eventually overcome by the provision of a mercury differential pressure-gauge, working under cool water. This gauge was used in conjunction with carefully calibrated test gauges of the Bourdon type. The tests showed no appreciable difference between the two pressure ranges. Other investigations included a test devised to check the effect of alterations in the size of a straight elementary nozzle, with the result that a similar velocity-coefficient curve was obtained, and a series of tests on "stream-line" convergent straight nozzles with different exit-shapes. The negative result of the latter series of tests points to the value of further investigation on the effects of entry conditions in general.

Electric Motors on German Farms.

The electric motor is used more than any other type of power equipment on German farms. A total of 746,819 electric motors, having a combined horse-power rating of 3,334,051, is employed. These motors represent 80 per cent. of all the power equipment used, and the only exception to the overwhelming use of the electric motor is on farms having an area greater than 200 hectares. While the electric motor is the predominating source of power on farms under 2 hectares in area, the total horse-power used is small in comparison with that used on the farms in the 50-hectare class, 90 per cent. of the power employed on these farms being provided by electric motors.—*Commerce Reports.*

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Municipal Trading at Sheffield.

The Sheffield Corporation Electric Supply Committee has decided to give notice to the Sheffield branch of the Electrical Contractors' Association, that the Corporation does not intend to continue, after March 31st next, the agreement with regard to the sale of electrical fittings under the Sheffield Corporation Act, 1918. Until the passing of the Electricity (Supply) Act, 1926, the Corporation could not sell electric light fittings to the public except through a contractor, although it was empowered under an Order granted some years ago to sell meters, radiators, &c., direct.

Municipal Hire-Purchase Schemes.

The Plymouth Electricity Committee has recommended the Corporation to adopt a scheme for the wiring of premises on an instalment system of repayment, and also a scheme for the hire-purchase of motors (from 0.5 to 12 h.p.), electric cookers, vacuum cleaners and other appliances. It is proposed that the payment for installations shall be spread over seven years in quarterly instalments. Payment for appliances will be made in twelve quarterly instalments.

In connection with the Hornsey hire-purchase scheme, the Corporation Electricity Committee recommends that all the local electrical contractors shall be invited to make use of the showrooms, and also that an allowance shall be made to those introducing customers who make purchases of apparatus, equal to half the ordinary trade discount when the purchase is for cash and 5 per cent. on hire-purchase transactions.

The Rationalisation of Industry.

Under the auspices of some 60 industrial and technical associations a Committee has been conducting an inquiry into the "rationalisation" of industry, and its first report was presented at a representative meeting on January 26th. It is proposed that the committee shall exist to form a link between the parties concerned and convene half-yearly meetings to discuss co-operative action in the direction of improved industrial organisation. Among the bodies interested are the Federation of British Industries, the British Engineers' Association, the British Association, and the British Engineering Standards Association.

Electric Power in Industry.

The series of Preliminary Reports upon the 1924 Census of Production, published with the *Board of Trade Journal*, is apparently completed so far as Great Britain is concerned. The report published with last week's *Journal* commences a series dealing with Northern Ireland. It shows that the textile industries had 21,390 kW of generating plant, as compared with 10,497 kW in 1912. The total capacity of electric motors installed was 21,224 h.p. The linen trades reported 16,038 h.p. of generating plant (against 8,680 kW) and motors aggregating 14,458 h.p. In the bleaching, dyeing, printing and finishing trades there was 4,654 kW of generating plant (against 1,507 kW), and the capacity of electric motors installed was 5,636 h.p. There was 620 kW of generating plant in use by the clothing trades and 1,413 h.p. of electric motors. The clothing and millinery trades had 435 kW of generating plant and 979 h.p. of motors, while the laundry, cleaning and dyeing trades reported 176 kW of generators and 317 h.p. of motors.

The Marking of Imported Lamps.

The Standing Committee (General Merchandise) appointed by the Board of Trade under the Merchandise Marks Act will hold an inquiry as to whether imported electric incandescent lamps should bear an indication of their origin, on February 6th and 7th, and if necessary February 8th. The inquiry will be held at the Board of Trade Offices, Great George Street, S.W.1, and communications should be addressed to the Secretary, Mr. E. W. Reardon, at that address.

New Spanish Radio Company.

The Spanish Trans-Radio Company has just been formed, with a capital of four million pesetas (about £143,000), which has been fully subscribed. This company, which has recently obtained a concession from the Spanish Government for a public international wireless service, comprises the National Spanish Wireless Company, the concessionary for all internal wireless services, which holds the rights in Spain for all Marconi patents; the Iberian A.E.G. Co., concessionary for the Telefunken Co.'s patents; and the Spanish Wireless Company, concessionary for the patents of the Compagnie Générale Française de T.S.F.—*Reuter* (Madrid).

Wages in the Engineering Industry.

Delegates from 28 trade unions connected with the engineering industry met in London on January 26th. Mr. J. T. Brownlie, president of the Amalgamated Engineering Union, occupied the chair, and, later, issued a statement announcing that the conference had decided to submit to the Engineering and Allied Employers' Federation a claim for a weekly increase of 8s. in the wages of plain time workers with a corresponding rise in the rates paid to piece workers. The conference considered the merits of a national demand as opposed to local applications, and decided upon the former course. A joint conference between representatives of the unions and the employers will be held in due course to consider the question.

The Glasgow Lighting Service Bureau.

The second annual report of the Scottish Electric Lighting Service Bureau, Glasgow, is a record of good work in advancing the knowledge of correct lighting, both within the electrical industry and among the public. The Glasgow Corporation Electricity Department has done all the wiring work and continues to supply, without charge, the electricity for lighting and heating at the Bureau, while all lighting equipment has been obtained on loan from the various manufacturers. During the year the attendance at lectures, &c., reached 3,241. Lantern slides and demonstration apparatus belonging to the Bureau have been made use of by various outside lecturers, and a large portable shop window, with complete electric lighting fittings, has been displayed at electrical exhibitions at Kilmarnock, Helensburgh, Greenock, Falkirk, and Dumfries, during the year. When advice has been sought, the district engineer (Mr. H. E. Hughes) has visited factories and mills, bakeries, churches, public libraries, exhibitions and halls, and has made general recommendations upon the application of illuminating engineering principles.

The British Commercial Travellers' Club.

The first annual meeting of this Club was held at the club premises, 24-28, New Oxford Street, W.C.1, last week, and a satisfactory report of progress was made by the Secretary. The club opened on March 19th last, with a membership of 216, and at the close of the year the number had reached 600. Lord Riddell has accepted the post of president for 1928.

An Employés' Share Scheme.

Imperial Chemical Industries, Ltd., has drawn up a scheme to enable the employés of the combine to acquire its ordinary shares on favourable terms. The only qualifications required by the employé are that he must have at least one year's service and be 21 years of age or over. The price of the shares will be 2s. 6d. less than the average market price during the week preceding the date of application. It is provided that an employé may not in any one year apply for shares of a value exceeding 20 per cent. of his salary, but the rule is relaxed to some extent in the case of men with more than five years' service. Payment for the shares may be made by instalments spread over a period of not exceeding two years. Additional shares are to be allotted free of charge in the following proportions:—Employés earning £200 a year or less, one for each four shares subscribed for; employés earning more than £200 but not exceeding £500 per annum, one share for each five subscribed for.

French Foreign Electrical Trade.

Statistics of the French Customs authorities for the first nine months of 1927 (reproduced in the *Revue Générale de l'Electricité*) show that the imports during that period of electrical machinery and apparatus reached a total value of 166,258,000 fr., as compared with 191,517,000 fr. for the corresponding period of 1926. The weight was 53,676 metric quintals, against 49,611 quintals. The imports of dynamo-electric machinery were valued at 40,274,000 fr. and other important items were apparatus wound with insulated wire 29,650,000 fr., apparatus not so wound 20,792,000 fr., metal-filament lamps 25,783,000 fr., and insulated wires and cables 17,705 fr. The exports during the nine months reached a value of 283,232,000 fr., as compared with 489,524,000 fr., although the weight rose from 186,391 to 210,266 metric quintals. The principal items in the list were dynamo-electric machinery 66,083,000 fr., apparatus wound with insulated wire 59,733,000 fr., radio apparatus and valves 29,158,000 fr., insulated wires and cables 23,612,000 fr., apparatus not wound with insulated wire 22,500,000 fr., and carbons 18,099,000 fr.

New North Metropolitan Showrooms.

The accompanying illustration of the new showrooms of the NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO., in the High Road, Wembley, shows these premises to be commodious and attractive. The building occupies a 60-ft. frontage and is centrally situated. The front is of red brickwork faced with stone. On the facia is a "Dayanite" sign and the building is flanked by two of the company's well-known "Use Electricity" signs. Four flambeaux are mounted above the entrance. The left-hand window is curtained off and will be used for special displays and demonstrations. The other

The New Wembley Showrooms of the North Met. E.P.S. Co.

window gives a clear view into the showroom—the side devoted to domestic apparatus. The entrance porch is tiled and there are ample windows at the sides. A panel type electric water radiator is embedded below the tiles, warming incoming air and preventing fog and mist from settling on the windows. One half of the showroom is utilised for the display of industrial and commercial appliances. Such apparatus as small electric furnaces and lighting fittings are shown here. At the rear of the showroom is a model electric kitchen, and a room which can be darkened for the effective demonstration of lighting systems and fittings. Ample office and store accommodation has been provided and on the top floor is a self-contained flat which will be occupied by a member of the staff. The showroom was formally opened during National Electric Week when Sir James Devonshire, K.B.E., met the local Council and a number of large consumers in the district. We are informed that although the district is comparatively small, about 2,000 new consumers are connected up annually.

Social Events.

The first annual dinner of the staff of Marchant & Co., electrical engineers, of Sandgate Road, Folkestone, was held on January 14th. Mr. R. W. Marchant presided.

A very successful dance was held by the management and staff of the Marconiphone Co., Ltd., on January 20th, at the Westminster Palace Rooms, Victoria Street, S.W.1. Over four hundred members of the company and their friends attended.

The Ideal Home Exhibition.

The annual Ideal Home Exhibition at Olympia is to be held from February 28th to March 24th. For this show the GENERAL ELECTRIC CO., LTD., is arranging what it claims to be "the most comprehensive range of electrical apparatus and appliances designed specifically for service in the home, ever gathered together for purposes of a public exhibition." From a description of the prospective display it would appear that the claim will be amply justified. Every kind of domestic appliance will not only be shown, but also demonstrated, and, in addition, the company's stand will bear some novel and beautiful settings for some of the principal appliances.

One item which will be shown is a new "Magnet" electric cleaner, which, it is claimed, embodies all the best of the features of the pattern which it will supersede, as well as sundry important improvements tending to greater efficiency.

Another electrical company who will be exhibiting is VOLTA, LTD. (vacuum cleaners). The company states that all sales at the exhibition will be credited to dealers.

A Metro-Vick Appointment.

Mr. E. H. W. Cooke, who occupies the position of comptroller in the Metropolitan-Vickers Electrical Co., Ltd., has recently been appointed chairman of Metro-Vick Supplies, Ltd., Cosmos Lamp Works, Ltd., and Harcourts, Ltd., the company's Birmingham factory where high-class electric light fittings, fires and other domestic helps are manufactured. The Cosmos Lamp Works is mainly concerned with the production of the company's lamps and radio valves, domestic appliances, such as cookers and fans, being manufactured at Trafford Park.

The Electrical Imports of Burma.

A report reproduced in the *Board of Trade Journal* shows that during the year 1926-27 electrical machinery to the value of Rs. 21.29 lakhs was imported into Burma, as compared with Rs. 22.87 lakhs in 1925-26. The reduction is accounted for by smaller consignments from the United States.

The Bristol Electric Club.

The inaugural smoking concert of the Bristol Electric Club was held at the Grand Hotel on January 20th. Mr. A. C. Baker, chairman, presided, and the electrical and allied industries were well represented. Mr. Baker, in a short speech giving details of the club and its purpose, stated that its aims and objects were to foster good fellowship, and to further the interests of the electrical and allied industries.

The idea emanated from the local committee which was formed some time ago in connection with the E.D.A.-E.L.M.A. Campaign. The membership was now 150, and was still growing. The club had been offered silver cups for competitions by the members. He felt that Bristol, as the centre of industry in the west, should certainly be able to maintain a club equal to those in Birmingham and other large cities.

Mr. W. Leslie Richards, chairman of committee, also spoke, giving a general outline of the proposed activities of the club. He laid particular stress on the fact that the industry was well catered for on the technical side, and it was the committee's desire that the club should be looked upon as a social one only. Mr. F. R. Ashmead, treasurer, gave a short report, and asked for assistance from the members in arranging the programme. Dr. Rixon, president of the Bristol Rotary Club, Mr. A. H. Dowson (W. D. and H. O. Wills), and Mr. W. Pugh, postmaster of Bristol, also spoke. An excellent concert was provided. The next meeting of the club will be held on February 17th, when it is hoped that Dr. Rixon will address the members.

Wages in the Contracting Industry.

THE NATIONAL FEDERATED ELECTRICAL ASSOCIATION, announces that in accordance with the national agreements governing wages in the electrical contracting industry, and with the variation in the cost of living, there will be a reduction of 27½ per cent. in the *basic* rate of wages, as from the second pay-day in February. This will actually involve increases in the rates—½d. per hour in the case of Grades A, C and D, and ¼d. in the case of Grade B. The hourly rates will therefore be as follows up to and including the period covered by the first pay-day in June:—Grade A, 1s. 9¾d.; Grade B, 1s. 7¾d.; Grade C, 1s. 6¼d.; and Grade D, 1s. 4¾d.

An Effective Head-dress.

The light-hearted (and literally light-headed) lady depicted in the accompanying illustration recently secured a prize at a

A Novel Dance Head-dress.

fancy dress dance. The head-dress was certainly effective, both as a novelty and as an advertisement of "Philips" lamps.

Climate and Commerce.

A booklet bearing this title has been compiled by DORLAND ADVERTISING, LTD., 14, Regent Street, W.1. The subject is of great importance for many reasons. Tables are given showing the average monthly rainfall and temperature of leading cities and districts in all parts of the world.

Recent Contracts.

MESSRS. JOSEPH KAYE & SONS, LTD., have recently secured contracts for a year's supply from all sections of both the L.M. & S. and L. & N.E. Railways, for their patent railway carriage door locks and handles, and they also have contracts in hand for the Great Western, Union of South Africa, Great Southern of Ireland, and Iraq Railways.

ELECTRICARS, LTD., has received an order from the City of Birmingham Salvage Department for a further four "Electricar" low loader vehicles.

The Damard and Mouldensite Amalgamation.

BAKELITE, LTD., is the new name of the Damard Lacquer Co., Ltd., & Mouldensite Ltd., who, as the result of a scheme of amalgamation, have joined forces. Headquarters are at 68, Victoria Street, S.W.1, and the works as hitherto, are at Birmingham, and Darley Dale. There is no change in the personnel of the staff. The arrangement also provides for Redmanol materials being supplied by Bakelite, Ltd.

Local Exhibitions.

MOTHERWELL AND WISHAW.—An electrical exhibition was recently arranged by the Motherwell and Wishaw Electricity Department (engineer: Mr. W. D. Brassington) at the Y.M.C.A. Hall, Motherwell. The following firms contributed electrical appliances, fittings, &c., to the exhibition:—The General Electric Co., Ltd., A. Low and Sons, Metro-Vick Supplies, Ltd., Credenda Conduits, Ltd., the British Thomson-Houston Co., Ltd., Siemens Electric Lamps & Supplies, Ltd., Electrolux, Ltd., Logan Electrical Supplies Co., W. C. Yuille & Co., Ltd., Wood & Cairns, L. G. Hawkins & Co., Ltd., Carron Company, Hotpoint Electric Appliance Co., Ltd., the Tellus Electric Cleaner Co., Ltd., A. Reyrolle & Co., Ltd., and the Singer Sewing Machine Co., Ltd. Demonstrations of electric cooking were given by Mrs. Peterson, of Credenda Conduits, Ltd., and sewing by electricity was demonstrated by a lady representative of the Singer Co. Vacuum cleaners, refrigerators, washing machines, and other appliances were also demonstrated. The exhibition was of particular interest since the Corporation is contemplating a scheme of assisted wiring and the hire-purchase of apparatus. The Scottish Lighting Service Bureau, Glasgow, lent a lighting demonstration apparatus. The exhibition was continued in Wishaw for a further week.

PADIHAM.—An exhibition of electrical cooking and domestic appliances was recently held in the Co-operative Hall under the auspices of the Padiham District Council. It was opened by Councillor Coe, chairman of the Electricity Committee, who said that at an early date the Council would open a showroom and sell electrical appliances direct. The Council was also considering a scheme for wiring houses under an easy-payment system.

Calendar.

The 1928 calendar of the LONDON ELECTRIC WIRE CO. AND SMITHS, LTD., is decorated with a print of the Fortune Playhouse, Golden Lane, completed in 1599. A note on the back of the calendar explains that the company's head office is on a part of the site of the building which was demolished very many years ago.

Trade Announcements.

Messrs. LINDLEY DUFFIELD & Co., LTD., have removed to Imperial House, Kingsway, W.C.2. Telephone: Gerrard 0351-2.

Messrs. ELLIS SYKES & SON, LTD., of Prince's Street, Stockport, have opened an electrical department in connection with their business.

The Leeds branch of the SUN ELECTRICAL CO., LTD., has been removed to 49, Park Place. (Telephone: 28511; telegrams: "Secabilis, Leeds.") At the new premises there are large and well-arranged showrooms and increased store-room space.

MESSRS. JOSEPH FOSTER & SONS, engineers and boilermakers, of Preston, have purchased Canal Foundry, Blackburn, from Messrs. Yates & Thom, who went into voluntary liquidation some time ago and closed the works about three months later, having paid out shareholders and all concerned in full.

Messrs. HOBDAY BROS., LTD., 21-27, Great Eastern Street, E.C.2, have recently opened a new department dealing with accessories, fittings, and sundries connected with household electrical work.

N.-K. (BRADFORD), LTD., has opened a stock-holding depôt at 74, York Street, Glasgow, where all kinds of electrical supplies will be available.

Messrs. LAMLOK, LTD., have removed from 237, Acton Lane, Chiswick, to 1a, Vivian Avenue, East, Wembley, Middlesex.

The Dundee branch of the EDISON SWAN ELECTRIC CO., LTD., has been removed to "Ediswan House," Bank Street, Dundee. There is a large trade showroom at the new premises.

New Catalogues and Lists.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Descriptive List No. 4196, centrifugal mechanisms for the electrical control of oil-immersed circuit-breakers; Descriptive List No. 4221-C, air break circuit-breakers (a.c. and d.c. up to 660 V); Price List No. 5112-C, oil-immersed Y-delta starters for squirrel-cage induction motors; and Price List No. 5302, d.c. motor control panels.

MESSRS. HANS RENOLD, LTD., Didsbury, Manchester.—A calendar-blotter advertising "Renold" standard stock drives.

GLEDHILL-BROOK TIME RECORDERS, LTD., Empire Works, Huddersfield.—An illustrated booklet describing the company's time recorders of various patterns.

MESSRS. PHILLIPS & TURNER, Cambridge Street, Birmingham.—A postcard illustrating examples of the company's tinned brass cable clips.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—A brochure illustrating the application of the "Metalix" tube to the apparatus of various well-known manufacturers of X-ray apparatus. Two separate leaflets describing the tube and its applications have also been received.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—Publications No. 839, dealing with the company's high-sped circuit-breaker; No. 900, describing "Kosfi-Leading" induction motors; and No. 988, describing the Wilkinson change-circuit system with "English Electric" induction regulators. All fully illustrated.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., High Holborn, E.C.1.—An illustrated booklet entitled "The Great Flood, January, 1928," which shows that amid the havoc wrought by the abnormal rising of the Thames "Henley" pillars carried on without trouble.

MESSRS. A. J. ASHDOWN, LTD., 119, Victoria Street, S.W.1.—A booklet describing the application of the Ashdown "Rotoscope" in various industries. It is a stroboscopic apparatus which gives a record of speed and speed variations.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Catalogue No. P.229, containing illustrations and particulars of the "Prescot" high-pressure d.c. localising bridge for use for tracing high-resistance faults.

THE CARRINGTON MANUFACTURING CO., LTD., Sanderstead Road, South Croydon.—An illustrated booklet and a leaflet, giving particulars and prices of "Camco" cabinets for radio sets.

Bankruptcy Proceedings.

L. W. WEAVER, 15, Argyle Street, W.—The public examination of this debtor was held on January 24th, before Mr. Registrar Mellor, at the London Bankruptcy Court. The receiving order was made on March, 1927, and accounts were furnished showing a surplus of £5,204, but the debtor has now lodged an amended statement of affairs, and returns a deficiency of £9,189. Replying to Mr. Gaine, Official Receiver, the debtor said that he started as a boot and shoe repairer, was next an Evangelical preacher, both in America and this country, then a fruit farmer in Canada, and a railway constructor in America. He had also been interested in a soap-making business and in the manufacture of a petrol substitute, the purchase of a coal mine, and the generating of electricity by means of tidal power. Early in 1923 he obtained a grant of letters patent in respect of an invention for generating electricity by means of tidal power; the Weaver Tidal Power Co., Ltd., was formed in July, 1924, to exploit the invention, and he sold his patent rights to the company for 50,000 2s. shares, but no electricity had yet been generated by the company, and he had disposed of all his shares. The scheme would have received support from the Electricity Commissioners and certain Government departments. After questions had been asked, the examination was concluded, the debtor stating that he expected an arrangement to be completed within a month, which would bring him in sufficient to pay his debts in full.

H. REES, 67, Chase Road, Morriston, Swansea, electrician.—The first meeting of creditors was held on January 25th, at the Official Receiver's offices, Swansea. The statement of affairs showed gross liabilities of £122, all of which was expected to rank for dividend, against assets estimated to produce £4, leaving a deficiency of £118. Debtor attributed his failure to want of capital, and under-estimating on contracts for electric wiring. The case being a summary one was left in the hands of the Official Receiver as trustee of the estate.

F. A. WILLIAMS, electrician, 96, Churchill Road, Great Yarmouth.—Last day for proofs for dividend, February 11th. Trustee, Mr. C. B. L. Prior, Official Receiver, 9, Queen Street Chambers, Norwich.

A. H. SMITH, electrical distributor, 3, Park Place, Cardiff.—Composition of 5s. in the £, payable at the Official Receiver's Office, 34, Park Place, Cardiff.

I. STEPHENSON (I. Stephenson & Son), plumber and electrician, 36 & 37, Flowergate, Whitby.—First and final dividend of 3s. 10d. in the £, payable January 30th, at Golden Lion Chambers, Whitby.

F. H. THOMAS and W. E. EVANS (Thomas & Evans), electrical engineers, Salubrious Chambers, Salubrious Passage, Swansea.—First and final dividend of 9¼d. in the £, payable at the Official Receiver's Offices, Government Buildings, St. Mary Street, Swansea.

F. S. RIPPINGILE, agent for electrical fittings, Winchester House, Victoria Square, Birmingham.—Last day for proofs for dividend, February 11th. Trustee, Mr. C. Hoult, Official Receiver, 191, Corporation Street, Birmingham.

P. FORD, electrical contractor, 4a, Macdonalds Lane, Corporation Street, Manchester.—Last day for proofs for dividend, February 11th. Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester.

G. C. LAZENBY, wireless engineer, 29, Old Town Street, Plymouth.—Last day for dividend, February 10th. Trustee, Mr. S. P. Booth, Kimberley House, Holborn Viaduct, E.C.

J. GLICKMAN (Manchester Radio Service), wireless factor, 10, 12, and 14, Gt. Ducie Street, Strangeways, Manchester.—First and final dividend of 1s. 2½d. in the £, payable at 47, Mosley Street, Manchester.

Private Arrangements.

R. W. ROBSON, trading as "Robson & Co.," electrical and motor engineer, 165, Liverpool Road, Birkdale. A meeting of creditors was held recently at the offices of Mr. P. S. Booth, 2, Bixteth Street, Liverpool, when a statement of affairs was submitted which showed liabilities of £387 and net assets of £51, leaving a deficiency of £336. The debtor was in partnership until 1911, when he started on his own account at Dover. In 1914 he went to Southport, and in 1926 removed to his present premises. It was stated that the fully-secured creditors held first and second mortgages on the property, while the partly-secured creditors were a firm of moneylenders who held a bill of sale upon the debtor's household furniture. Certain creditors were said to have threatened proceedings, and the second mortgagee had given notice calling in his mortgage. In view of that a deed of assignment had been executed in favour of Mr. Booth in order to protect the estate. The creditors resolved to confirm this deed. The following are creditors:—

	£		£
Electrical Supplies (Liverpool), Ltd. ...	36	Baxter, W.	56
Willis, R.	120	Jepson, C.	56

E. F. BRETT, electrical engineer, Priory Place, Doncaster.—A meeting of creditors was held recently at Doncaster. The representative of the Electric & General Stores, Ltd., the principal trade creditors, was elected to the chair. Mr. C. Barnsdale, 45, Netherhall Road, Doncaster, submitted a statement of affairs which showed the following liabilities: Sundry creditors £1,476, bankers £3,156, and mortgagee £1,200. The bank was also secured by mortgages. The assets were estimated to realise £7,879, and the estate thus showed a surplus. The debtor commenced undertaking electrical work in 1918 with a capital of between £100 and £200. In 1920 he acquired business premises and commenced his present undertaking. At that time his capital amounted to £1,500. Durling the period ended March 31st, 1921, the turnover was £5,321, with a profit of £748, and in the following year there was a profit of £1,645, on a turnover of £8,500. The next year the turnover fell to about £7,000, and the profit to £161. Since that date losses had been incurred. The debtor desired to continue the business, and the prospects were favourable. The creditors agreed that the business should be continued. There were pressing creditors, and it was decided that a deed of assignment should be executed to Mr. Barnsdale, with a committee consisting of the chairman, and the representatives of Electrical Conduits, Ltd., and the Sloan Electrical Co., Ltd. The following are creditors:—

	£		£
Baxendale & Co., Ltd. ...	36	General Electric Co., Ltd.	66
British Thomson-Houston Co., Ltd.	28	Masterman & Co., Ltd.	114
Callender's Cable & Construction Co., Ltd. ...	40	Metro-Vick Supplies, Ltd.	38
Geo. Casperson	60	Philips Lamps, Ltd. ...	51
Electrical Conduits, Ltd.	200	Sloan Electrical Co., Ltd.	145
Electric & General Stores, Ltd.	277	Smith Bros.	41
Electric Lamp Factors, Ltd.	118	Vickers & Sons, Ltd. ...	30
		Woodhouse & Sons ...	40

Dissolutions of Partnership.

WILLIAMS ELECTRIC LIGHTING Co., dealers in electric light and gas fittings and accessories and wireless apparatus, 212, High Street, Stoke Newington.—Mr. W. Lubelsky and Mr. N. Ruda have dissolved partnership. Mr. Ruda will attend to debts.

CORNALL & METCALFE, motor engineers and electricians, Commercial and Ribblesdale Garages, Gisburn, York.—Mr. G. Cornall and Mr. T. Metcalfe have dissolved partnership.

Company Liquidations.

GILLAN RADIO-ELECTRIC, LTD., 64, High Holborn, W.C., electrical and radio engineers, &c.—A meeting of creditors was held recently, when Mr. W. G. Ansele, liquidator, who presided, said that he had been the works manager of the company. No statement of affairs had been prepared, but the liabilities to the trade creditors amounted to £201, and there was £100 due to the landlord. Mr. W. Greenwood, managing director of the company, was also a creditor for £150 in respect of salary not drawn, and loans. Most of the stock had been sold for about £30, and the liquidator had about £20 cash in hand. He anticipated that the remaining stock and office furniture would realise another £20. There was also a considerable amount owing for book debts, but it was doubtful if anything would be realised. No profit and loss accounts had been prepared, but the turnover since February 28th last, the date of the company's incorporation, was just over £1,000. The creditors decided to adjourn the meeting. At the adjourned meeting, on January 23rd, Mr. Greenwood said that altogether he had received 800 shares for stock and the goodwill of the business, and 202 shares were issued for cash. He also said that he advanced the company about £185, and he had not received anything since April last. No resolutions were passed, and the matter, therefore, remains in the hands of Mr. Ansele as liquidator.

FRANK CRAFT (CASTLEFORD), LTD.—Liquidator, Mr. G. G. Poppleton, 26, Corporation Street, Birmingham, released November 1st.

ARMSTRONG-WHITWORTH SALES CORPORATION, LTD.—Winding up voluntarily. Liquidator, Mr. F. N. S. Darby, Kinnaird House, Pall Mall East, S.W.1.

ORFORD ELECTRIC LIGHT & POWER Co., LTD.—A meeting of creditors was called for February 1st, at the Power House, Orford.

New Municipal Showrooms.

New showrooms were opened in Market Street, Cleckheaton, on January 28th, by the Spenborough Urban District Council Electricity Department. The opening ceremony was performed by the chairman of the Council, Mr. J. W. Heywood, who was presented with a gold key by Mrs. Pickersgill, wife of the Council's electrical engineer. During the afternoon there was a demonstration of cooking by electricity, and there were on view all manner of domestic electrical and electromedical appliances.

Hungarian Electrical Exports.

The *Board of Trade Journal* states that during November last Hungary exported electrical machines and apparatus of the value of 2,089,000 pengös (£74,500 approx.)

Book Notices.

"Papers of the Safety in Mines Research Board." No. 38: "The Pressures Produced on Blowing Electric Fuse Links," by Messrs. G. Allsop and R. V. Wheeler; H.M. Stationery Office, price 1s. 6d. net. No. 39: "The Pressures Produced by Electric Arcs in Closed Vessels," by the same authors; H.M. Stationery Office, price 9d. net.

"Scientific Papers of the U.S.A. Bureau of Standards." No. 564: "Absolute Measurement of Capacitance by Maxwell's Method" (15 cents). No. 566: "Indeterminateness of Electrical Charge" (5 cents).

Selected Papers from the *Journal* of the Institute of Electrical Engineers of Japan. No. 14: "On the Grounding of Long-distance Transmission Line Compensated through Petersen Earth Coils." Published by the Institute, Tokyo, Japan.

Technologic Papers of the U.S.A. Bureau of Standards. No. 355, "Electrolysis Testing." (30 cents.)

"What's Wanted and Advice to Inventors," 2nd Edition. Issued by the Institute of Patentees (Inc.), 39, Victoria Street, S.W.1. Price 6d. post free 8d.—Several articles have been added to this new edition and the old ones considerably revised. Over 200 wants have been added.

"Physics in Medical Radiology," by S. Russ, L. H. Clark and B. D. H. Walters. Pp. xii+234; 72 figs. London: Chapman & Hall, Ltd. Price 12s. 6d. net.

"Quarterly Bulletin of the Institution of Engineers, Australia." Vol. IV, No. 16, October, 1927.

"Quarterly Bulletin of the British Cast-Iron Research Association." No. 19. January, 1928.

For Sale.

By order of the directors of Messrs. Tyer & Co., Ltd., late of Carlisle, who have removed their works to Darlaston, Messrs. W. L. Tiffen & Sons, in conjunction with Messrs. Fuller, Horsey, Sons & Cassell, will sell upon the premises, Denton Holme, Carlisle, the freehold engineering works and the plant, machinery and contents of the works, &c. The City of Worcester Electricity Department has for disposal two 400-kW Belliss & Morcom triple-expansion engine-alternators. Birmingham Electric Supply Department has for disposal one Belliss & Morcom steam turbine coupled to one 2,500-kW G.E.C. alternator, with exciter, surface condenser, air pump, &c. Colchester Corporation Electricity Department has for disposal several surplus generating sets and four Davey, Paxman boilers. Lincoln Corporation Electricity Department invites offers for one 750-kW turbo-alternator and exciter, with surface condenser, air pump, oil cooler and air filter, and two l.p. a.c. switchboard panels. Derby Corporation Electricity Department has for disposal two 750-kW motor alternator sets. (See our advertisement pages to-day.)

Anglo-Italian Trade Conference.

It is announced that representatives of the Federation of British Industries will shortly visit Rome to discuss trade relationships with Italian industrialists.

Unemployment.

During the week ended January 16th the number of registered unemployed fell from 1,232,070 to 1,193,800, a decrease of 38,270. The total on January 17th, 1927, was 1,391,020.

Prices of Raw Materials.

In their letter dated January 28th, Messrs. James Forster and Co. stated that the market had again been dull and featureless, with an easier tone in evidence during the last two days. The heavy buying of forward lead had ceased for the time being, and prices eased off. Supplies, meanwhile, are ample for all requirements, and so long as demand continues in its present state a tendency to a lower level of prices must be expected.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, January 31st:—No change in copper prices.

Messrs. James & Shakespeare report, January 31st:—English pig lead, £22 10s., 15s. dec.

Messrs. Edward Till & Co. report, January 31st:—India-rubber, Para fine, 1s. 3½d., ½d. dec.

Lighting and Power Notes.

Auckland (Durham).—OPPOSITION TO BILL.—At a recent meeting of the Rural District Council it was decided to lodge a petition against the Bill which will be presented in Parliament shortly, by the Cleveland and Durham County Electric Power Co. The clerk pointed out that under the existing Order which applied to the rural district, the company's charges were limited to a maximum of 8d. per kWh. In the new Bill it sought to increase the price to 1s. per kWh.

Audlem.—ELECTRICITY SUPPLY.—Efforts are being made to obtain a supply of electricity for Audlem from the North Wales Electricity Distribution Co. A local committee has been formed to canvass the district, and a good number of prospective consumers has been secured.

Australia.—SYDNEY.—The *Electrical Engineer of Australia and New Zealand* reports that the City Council has unanimously adopted the report of Mr. H. R. Forbes Mackay, general manager of the electricity supply department, recommending the extension of the 33,000-V mains from the present termination at Blacktown. A single line is to be run to Richmond, taking in Riverstone and Windsor, and a similar service given to Penrith, embracing St. Mary's, with a branch to Emu Plains. An interconnection is to be made between Penrith and Richmond. The estimated cost of the whole work is £55,000. Subject to a satisfactory revenue being assured, bulk supply will be given to the following local bodies:—Windsor, Richmond, St. Mary's and Penrith municipalities, and Blue Mountains and Castlereagh shires. The tariff will be £10 per annum per kVA of maximum demand, plus 0.9d. per kWh. For the Riverstone Meat Co., provided it contracts to take or pay for not less than 1¼ million kWh per annum, the rates will be £7 and 0.75d. respectively.

Blackburn.—CONSULTING ENGINEER'S REPORT.—The General Purposes Committee has discussed the report on the town's electricity undertaking, prepared by Mr. A. H. Dykes, consulting engineer, and has decided to convene a further meeting and to invite Mr. Dykes to attend to answer questions arising out of his report.

Boston.—ELECTRICITY SUPPLY.—The Rural District Council, East Elloe Rural District Council, Holbeach Urban District Council, and Long Sutton Urban District Council have all given general approval to the use of overhead lines in their areas by the Boston and District Electric Supply Company, Ltd.

Brighton.—STREET LIGHTING.—The Corporation Lighting Committee has recommended a scheme for overhead suspension with central lighting for main roads, increasing the candle power of lamps in side streets, and the provision of festoon lighting.

Bury.—LOANS SANCTIONED.—The Corporation has received sanction to loans of £33,301 for a 10,000-kW turbo-alternator and condensing plant, and £35,288 for boilers, &c.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—In a memorandum prepared by the chairman of the New Brunswick Electric Power Commission, it is stated that the present installations in hydro-electric plants in the province of New Brunswick total about 40,000 h.p. The largest power site in the Maritime Provinces—Grand Falls—is now being developed by the Saint John River Power Company, a subsidiary of the International Paper Company, with an initial installation of 60,000 to 80,000 h.p. With the completion of this development, this year, about one-half the total power capacity in the province will have been developed. Undeveloped sites will then total about 120,000 h.p. With the exception of one on the Saint John River, these are of comparatively small capacity. During the year the Commission has constructed 66 miles of new distributing lines, and now operates over 200 miles of distributing lines, in addition to the 100 miles of h.p. line between the Musquash River hydro-electric plant and Moncton, and 37 miles in the North Shore line. Power requirements were 15 per cent. in excess of the previous year on the southern system, and since May 1st, 1924, the annual output of the Commission has increased from 7 million kWh to 22.5 millions. The total number of consumers now served is almost 15,000.

Chelmsford.—ELECTRICITY SUPPLY.—At a recent meeting of the Town Council it was reported that the Electric Supply Corporation, Ltd., had intimated that the charge for lighting purposes would be reduced by 1d. per kWh after the end of the current quarter. The Council decided that the matter be referred back with a view to getting a further reduction. It was also reported that the Electric Supply Corporation had rejected the offer to purchase the undertaking for £60,000, and had stated that it would not accept less than £84,000.

Continental.—CZECHO-SLOVAKIA.—Nearly one-third of all parishes in Czecho-Slovakia are now provided with an electricity supply. Commencing last year and continuing till 1931, a Government subvention of 10 million crowns per annum appears in the annual State budget for the purpose of assisting villages situated in outlying places and in mountain districts. Over 700 villages have already been assisted by means of a grant from the Government subvention.

RUSSIA.—The Ukraine Government has authorised a programme of electrification work for the fiscal year 1927-28. In the Donetz basin the capacity of the existing power stations is to be increased by 16,000 kW, and, in addition, it is proposed to erect two new stations with a total output of 25,000 kW. A sum of 13,200,000 roubles is to be spent on electrical schemes connected with the coalfields, and 8,000,000 roubles is allotted to the building of a 30,000-kW power station for the iron mines. For the iron and steel industry new sets are to be installed, one of 4,000 kW for the Rykow concern, and another of 12,600 kW for the Mariupol works; and a 26,000-kW plant is proposed for the Kramatorski works at a cost of about 9,000,000 roubles. A 22,000-kW turbo-generator is destined for the Sterowka power station, while 12,000,000 roubles is allotted to the construction of the Es-Char power station near Charkow and the necessary transmission lines. In addition, about 10,000,000 roubles is to be expended on extensions of the communal electric power system of the Ukraine.

AUSTRIA.—Plans have been drawn up for the establishment of hydro-electric plant near the Austrian capital to utilise the water power of the River Danube. The scheme provides for the erection of three generating stations on the stretch of the river between Klosterneuburg and Hainburg. The chief station would be equipped with six 15,000-kVA Kaplan vertical-shaft turbo-generators, and the other stations each with six sets of 10,700 kVA capacity. It is estimated that an annual output of 940 million kWh could be attained and that the cost of the installation could be recovered within a period of eighteen years.

FRANCE.—A new company has been formed in Paris with the title La Société Hydro-Electrique de la Cere to establish three power stations with a total capacity of 63,000 kW, to utilise certain falls on the River Cere, near Laroquebrou, about 20 miles from the town of Aurillac. The first set has recently been completed.

Croydon. — ELECTRICAL DEVELOPMENT. — The Corporation Electricity Committee has prepared estimates for the next 12 months involving an expenditure of £106,000 on works, distribution, and mains.

Fylde.—SCHEME APPROVED.—The Rural District Council has given its assent to the application of Preston Corporation for a Special Order authorising it to supply electricity in the townships of Clifton-with-Salwick, Newton-with-Scales, Treales, Roseacre-with-Wharles, Little Eccleston-with-Larbreck, Elswick, Greenhalgh-with-Thistleton, Medlar-with-Wesham, and Ribby-with-Wrea, all in the Council's district.

Glasgow.—SPECIAL COMMITTEE'S REPORT.—The Special Committee, appointed by the Corporation in August last to consider the administration and working of the Electricity Department, has issued its report.

Hornsey.—NEW SUB-STATION.—The Corporation Electricity Committee is to provide a new sub-station in Priory Road, at a cost of £25,500.

Japan.—ELECTRICAL DEVELOPMENT.—It is understood that an application for permission to develop 263,000 kW from the Shinano River has been presented to the Nagano Prefectural Office by the Shinano-gawa Denki Kogyo K.K. The estimated total cost of construction is 63,000,000 yen. The first station will have an output of 136,000 kW, and the second station of 52,000 kW.

It is learned that a project has been commenced by the Niigata Denki K.K. and others for developing electricity at the Tazzwa Lake in Fukushima Prefecture. The plant will have a capacity of 40,000 kW.

London.—ST. PANCRAS.—The Borough Council Electricity Committee has received sanction to the following loans:—Mains and services, £26,718; machinery, £4,793; meters, £6,056; wiring installations, £619; and domestic apparatus, £2,400.

The Committee is to extend the Highgate Road sub-station and provide an additional motor convertor at a cost of £18,220.

BATTERSEA.—The Electricity Committee is to enlarge all the mains on the Shaftesbury and Beaufoy estates to meet the demands for electricity for heating and cooking, and meanwhile sub-feeders are to be laid at a cost of £5,000. The Committee has authorised mains extensions for private services at a cost of £1,492, for public lighting at £566, and electricity services to 72 premises at a cost of £700.

STOKE NEWINGTON.—The Electricity Committee has recommended the introduction of the following alternative two-part tariffs:—Lighting and all domestic uses in private residences only: 2s. per quarter per 60-W lamp or equivalent installed, plus 1d. per kWh for electricity consumed per quarter. Shop window lighting after closing time and general lighting where only a lighting supply is taken: £2 10s. per kW demanded per quarter, plus 1d. per kWh for electricity consumed.

HAMPSTEAD.—At a meeting on January 26th, the Borough Council adopted a recommendation of the Electricity Committee to improve the public lighting in a number of thoroughfares by replacing the two 60-watt gasfilled lamps in each lantern by two 150-watt lamps fitted on double swan necks, the height being increased by about 3 ft.

STEPNEY.—An inquiry was to be held at Limehouse Town Hall by Col. T. C. Ekin on February 1st into the Borough Council's application for a Special Order authorising it to carry out extensions at Limehouse power station.

Morecambe.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £3,000 for mains, sub-stations, and equipment.

Newtown (Mont.).—ELECTRICITY SCHEME.—The Urban District Council has discussed the question of an electricity scheme for the town, and a committee has been appointed to visit Welshpool and obtain full particulars as to the cost of the scheme there.

New Zealand.—LAKE COLERIDGE.—The report of the Lake Coleridge hydro-electric undertaking for the year ended March 31st last shows a total income of £150,240, as compared with £123,355 in the preceding year. Working expenses amounted to £30,728, as against £27,035, leaving a gross profit of £119,512 (£96,320). After payment of interest, depreciation, and sinking fund charges there was a net surplus of £10, as compared with £16,739 in 1925-26. The electrical energy generated amounted to 78,342,797 kWh, and the maximum supply demanded 16,880 kW. During the year two 7,500-kW Vickers-Peebles generating sets were put into commission.

WAIKATO (HORAHORA).—The accounts of the Horahora undertaking for the year ended March 31st last show a total revenue of £108,748, from which were deducted working expenses (£28,713), interest (£37,989), depreciation (£16,481), and sinking-fund charges (£8,448), leaving a net surplus of £17,116. The sales of electrical energy increased from 60,261,326 to 75,844,229 kWh, and the maximum supply demanded from 11,360 to 14,160 kW. Delays have occurred in the construction work at the Arapuni power station, with a consequent shortage of power in the system. Arrangements are being made, however, to make temporary provision by the installation of three Diesel sets, mainly to supply the demand from Auckland.

MANGAHAO.—The report on the Mangahao undertaking for the year ended March 31st last records a total revenue of £101,897, from which the following charges had to be met:—Working expenses, £26,921; interest, £98,881; depreciation, £32,997. There was, therefore, a net loss for the year of £56,902. The electrical energy sold increased from 45,131,120 to 73,842,017 kWh, and the maximum supply demanded from 44,846 to 111,082 kW.

In addition to extensions to existing schemes, the Public Works Department is erecting a station at Lake Waikaremoana, which will have a capacity of 40,000 kW, and is to construct a new station in the South Island at Kurow on the Waitaki River, with a capacity of 30,000 kW. This station can be increased, if desired, to 75,000 kW.

Northern Ireland.—BELFAST.—An important extension at the Corporation power station, which includes the installation of a new 18,750-kW turbo-alternator, is nearing completion. There is a steady increase in the demand for electricity, principally for domestic consumption, and the electricity sold last year exceeded the sales of the previous year by nearly eight million kWh. Arrangements are under consideration for the supply of electricity to Lisburn, Holywood and Bangor, and it is possible in the near future that the Belfast station will become the source of supply for a considerable area of Northern Ireland.

Oban.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £6,454 for electricity purposes.

Portsmouth.—INAUGURATION OF NEW PLANT.—A new 10,000-kW set was formally inaugurated at the Corporation electricity works by the chairman of the Electricity Committee on January 18th.

Preesall (Lancs.).—OVERHEAD LINES.—The Council has received sanction from the Ministry of Transport to the erection of overhead transmission lines to carry electricity at 416 and 240 V, subject to the lines being erected along prescribed routes. The Ministry reserves the right to review the situation after five years.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

HULL.—Lighting: Flat rate from 5d. to 4½d. per kWh; maximum demand system from 6d. and 2d. per kWh to 6d. and 1½d. per kWh; domestic tariff, from ¾d. to ½d. per kWh. Power (other than special agreements), from 2d. and 1d. per kWh to 2d. and ¾d. per kWh.

LEAMINGTON.—Lighting: A reduction of ½d. per kWh. Two-rate low scale: A reduction of 1d. per kWh. Small power users: A reduction of 1d per kWh.

LEEDS.—Lighting: From 5d. to 4½d. per kWh.

FOOTS CRAY.—The Foots Cray Electricity Supply Co., Ltd.—Lighting: From 7d. to 6½d. per kWh. Heating and domestic purposes: From 2d. to 1½d. per kWh. Power: From 3d. to 2d. per kWh.

Southampton. — NEW PLANT. — The Town Council has applied for sanction to install a further turbo-alternator set at the electricity works, and to a loan of £96,600 to meet the cost.

Southend-on-Sea.—ELECTRICITY SUPPLY.—The Corporation has considered proposals for meeting the demand for electricity during the winter of 1928-29, and a quotation is to be obtained from the County of London Electric Supply Co., Ltd., for a bulk supply. In the meantime the Corporation has approved a recommendation that application be made for sanction to install one 1,200-kW Diesel engine set, and to a loan of £41,463 to cover the cost of the set and the necessary converting plant.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Urban District Councils of Alderley Edge and Wilmslow, authorising the constitution of a Joint Board for the supply of electricity in the urban districts of Alderley Edge, Wilmslow, and Handforth, and parts of the rural districts of Bucklow and Macclesfield; the Urban District Council of Uttoxeter to supply electricity in the urban district and certain parishes in the rural districts of Uttoxeter, Cheadle, and Sudbury; the Teignmouth Electric Lighting Co., Ltd., to supply in the urban districts of Ashburton and Buckfastleigh, and parts of the rural districts of Newton Abbot and Totnes; and the Braunton Electric Light and Power Co., Ltd., to supply in certain parishes in the rural district of Barnstaple.

The Commissioners have submitted to the Minister of Transport, for confirmation, a Special Order authorising the Bridgewater and District Electric Supply and Traction Co., Ltd., to supply electricity in part of the rural district of Bridgewater.

Stockport. — SUB-COMMITTEE'S CONTINENTAL TOUR.—Seven members of the special sub-committee appointed by the Town Council have left for the Continent to inspect electrical plant in connection with the proposed installation of a 20,000-kW set at the electricity works. There was a wide difference in the price of a Continental and British tenders, and the sub-committee was appointed to go into the matter and report to the Council. The places to be visited include Paris, Amsterdam, Zurich and Strassburg.

Stoke-on-Trent. — LOANS SANCTIONED. — The Corporation Electricity Committee has received sanction to the following loans:—Generating plant, £130,000; mains, £18,000; sub-station equipment, £5,000.

Stretford.—PROPOSED ELECTRICITY BOARD.—The proposal to form an electricity board for the Stretford area of Lancashire has been approved by the Council, and a Bill will be promoted in the next session of Parliament. The Board will be composed of representatives of the Councils of Stretford, Urmston, and Barton.

Wirral (Cheshire).—OBJECTIONS OVERRULED.— The objections of certain landowners in the area to the erection of overhead transmission lines by the Birkenhead Corporation have been overruled by the Ministry of Transport. In consequence of the objections the development of the Corporation's scheme in the Sutton district has been considerably delayed, and this has provoked protests by local councils.

Tramway and Railway Notes.

Australia.—ADELAIDE.—According to the *Electrical Engineer of Australia and New Zealand*, proposals for the conversion to electric traction of the steam railway from North and South Terrace, Adelaide, to the suburb of Glenelg have been considered, and the latest proposal is that the Adelaide Municipal Tramways Trust shall purchase the lines from the Railway Commissioner and use them for running tramway services linking up with the general city tramways. The Glenelg Council and Marion District Council would be brought into the trust. The complete cost of the conversion to this form of electric traction would be about £300,000, and Mr. W. G. T. Goodman, general manager of the Tramways Trust, is confident that the services would pay. The track gauge would have to be altered, the lines bonded, and an overhead bridge constructed to cross the railway tracks at Goodwood. The Government is favourable to the work being proceeded with immediately, and the necessary enabling Bills will probably be introduced into Parliament at an early date.

MELBOURNE.—The Melbourne Tramways Board has decided to recommend that the cable tramway from Spencer Street *via* Collins Street, Melbourne, and Victoria Street to Victoria Bridge, Richmond, be converted to electric traction. The line connects at Victoria Bridge with an electric line serving Kew, Camberwell, and Mont Albert, and when it is converted, through traffic will be run between the city and these suburbs. Some time ago it was the opinion of the Board that electric tramways should not be laid in Collins Street, but it has been demonstrated that overhead wires do not interfere with the appearance of the street.

Continental.—HUNGARY.—The Hungarian Trans-Danubian Electrical Co., the share capital of which is held by the Government, has entered into agreements with the Ganz Co., of Budapest, and with the Power and Traction Finance Co., Ltd., of London, for the carrying out of an important scheme of electrification in Hungary. A power station with a capacity of 65,000 kW is to be constructed at Banhida, in the Tata mining district, and the energy there generated from low-grade brown coal will be transmitted to Budapest, in the east, and to Moson, near the Austrian frontier, in the west, and will be used for giving bulk supplies to the cities and towns on the route and for the electrification of the main railway from Budapest to the frontier near Vienna. The total cost of the works is estimated at £2,500,000, of which approximately £1,000,000 is stated to represent orders for British manufacturers.

Glasgow.—PINKSTON STATION.—In connection with the proposal to recondition the plant at Pinkston power station, at a cost of £237,000, Mr. L. MacKinnon, the Corporation tramway manager, has issued a statement to the Tramways Committee criticising the report of the Electricity Department. He states that Mr. R. B. Mitchell's (the engineer's) figures are wrong. The normal rating of the two machines referred to is 5,000 and 10,000 kW respectively. The maximum rating is 7,000 and 15,000 kW, and Mr. Mitchell is not in a position to state what the full load of the tramways may be. There are 50 new cars on order with high-power motors, and this will substantially increase the load. The Electricity Board has already definitely excluded Pinkston from its scheme, and the engineers are well aware that it would cost £400,000 to alter the Pinkston and sub-station plant and bring it into the scheme. What Mr. Mitchell suggests is that the tramways should come under the 50-cycle periodicity and spend this £400,000 themselves. After having done so, there would be no increase in plant or output, and more would be spent than is involved in the tramway proposal. Concluding, Mr. MacKinnon states that the offer to supply 7,000 kW would be useless to the Tramways Department. The second alternative is to supply the entire tramway load at 0.3226d. per kWh. If the fixed charges on the Pinkston plant which would still remain were added to this, there would be no advantage compared with the figure at which the Tramway Department can produce electricity. In this connection, however, it is clear from the figures of the Central Electricity Board, published in 1927, that the charge by the Board to the Electricity Department for electricity in 1930-31 is estimated to be 0.529d. per kWh. If the Electricity Department supplied the tramway with 80 million kWh at 0.3226d. per kWh, it would lose on the tramway supply for this year £58,800, and in four years it would be supplying electricity to the tramways at over £215,000 less than the price charged it by the Board.

Glossop.—PROPOSED PURCHASE OF UNDERTAKING.—The town clerk has submitted a report of his interview with Mr. Anderson, of the Urban Electric Supply Co., Ltd., on the company's discontinuance of the tramway system in the borough, and also of an interview with the Corporation's consulting engineer on the matter. The Corporation has asked the engineer to report as to the present value of the undertaking with a view to continuing negotiations with the company for the purchase.

Lancashire.—PROPOSED TRANSPORT CO-ORDINATION.—The managers of the tramway and 'bus services of Burnley, Nelson, and Colne Corporations have been instructed to consider and report on the question of co-ordination.

Preston.—PROPOSED TRANSPORT BOARD.—The Corporation Tramways Committee has recommended the appointment of representatives to a conference of local authorities at Blackburn to consider the advisability of forming a Tramway or Transport Board for the running of through omnibus services in the area.

Rawtenstall. — REMOVAL OF TRACK. — The Corporation General Purposes Committee has decided, subject to satisfactory arrangements with the County Council and the Ministry of Transport, to reconstruct Burnley Road East and have the tramway track removed. The Waterfoot-Water service was opened in 1911, and recently the tramway service has been partially replaced by 'buses.

Rotherham.—PROPOSED NEW TRAMWAY.—The Corporation Tramways Committee is seeking powers for the construction of a tramway about five miles in length in the districts of Whiston, Wickersley, Bramley and Maltby.

Sunderland.—TRAMWAY EXTENSIONS.—Subject to agreement with the Highways Committee, the Corporation Tramways Committee has decided to extend the tramway from Sea Lane to Whitburn, and also from the Sunderland Children's Hospital to the new suburb of Humbledon, the total extension of the system being over two miles.

Telegraph and Telephone Notes.

Hull Telephone Service.—YEAR'S SURPLUS.—The annual estimates presented at a meeting of the Corporation Telephones Committee showed a probable surplus of £11,049 on the present year's working. On a total estimated expenditure of £117,070 it was shown that the probable expenditure would work out at £116,883. The Committee approved of next year's estimates to a total figure of £119,220, the estimated surplus being £11,075, and agreed that there should be a public opening of the two new branch automatic exchanges in North and South Newington.

Northern Ireland.—TRANSATLANTIC TELEGRAPHY.—The Western Union Telegraph Co. opened a new office in Belfast on January 26th, thus inaugurating a direct cable telegraph service between that city and New York.

Portugal.—TELEPHONE SERVICE.—The Minister of Commerce and a representative of the Anglo-Portuguese Telephone Co., Ltd., signed a contract on January 25th embodying certain alterations in the company's old contract. The company is to submit within a certain limit of time a tariff scheme providing for payment for each call.—*Reuter* (Lisbon).

Sweden.—TELEGRAPH AND TELEPHONE SYSTEMS.—The Government has authorised the telegraph authorities to spend kr.5,970,000 during the next year on the extension of the telegraph and telephone systems. A sum of kr.1,900,000 will be used for telephone cables between Stockholm and Gaefle and Norrkoeping and Linkoeping, and kr.3,350,000 for the continued construction of automatic telephone exchanges at Stockholm and Gothenburg.—*Reuter's Trade Service* (Stockholm).

Telephone and Telegraph Services.—ACCOUNTS.—The Post Office's commercial accounts for the year ended March 31st, 1927, show that the surplus on the telephone service reached £283,375, against £550,830 in the previous year. The deficit on the telegraph service was £1,349,112, approximately £50,000 more than in 1925-26. The income from telegraph business was £4,777,295, a decrease of £61,582, and that from telephone business was £17,302,674, an increase of £1,365,123. The expenditure on both services amounted to £912,894, an increase of £28,290, while depreciation thereon reached £4,664,225, some £525,692 more than in the previous year.

The Telephone Service.—NOTTINGHAM AUTOMATIC AREA.—Nottingham enjoys the distinction of being the first English city in the 1928 Post Office programme of conversions from manual to automatic telephones. With a population of 263,000, the city scheme covers a multi-office network comprising the central exchange in George Street and three satellites at Sherwood, Arkwright Street, and Basford respectively. The system is four and five digit, some subscribers having had four- and others five-figure numbers allocated to them. Operators at six manual exchanges will dial-in direct to Nottingham automatic subscribers, but outgoing traffic will still be handled manually, the operators at Nottingham also extending calls incoming to Nottingham automatic subscribers from outlying manual exchanges. The Central exchange is at present equipped for 7,500 lines, of which 1,170 serve private-branch exchanges, whilst 150 are allocated to coin-box telephones. In addition to line switches, the equipment includes 12 trunk boards accommodating group selectors: the first group selectors serve both main and satellite exchanges; apart from line switches, the switching equipment at the satellites is confined to second, third and final group selectors. The line switches are associated with the "graded" method of trunk distribution; the wipers do not remain on the contacts corresponding with the trunk last used by that particular switch, but return to the "home" position whenever the calling subscriber replaces his receiver at the conclusion of a conversation. The advantages claimed for this principle are economy in switching equipment and more efficient trunking. The satellite at Arkwright Street has a present capacity of 1,500 lines and an ultimate one of 2,000 or 3,400 by adding another floor. Sherwood is equipped for 2,000 lines, and ultimate expansion to 3,200, whilst Basford serves 1,500 at present and aspires to 2,200. The duplicate main batteries are of the Tudor Accumulator Co.'s manufacture, and the charging motor-generator sets were furnished by Newton Bros., Derby. At the satellite exchanges the Tudor battery charging machines are by Cromptons, of Chelmsford, and are only duplicated at Basford. Comprehensive supervisory equipment applies to both Central and satellite exchanges, and the whole system may be supervised from Nottingham when no local maintenance staff is on duty at the satellites. The new automatic service gives Nottingham a telephone density of approximately 5 per cent., or one telephone to every 20 inhabitants, and the whole of the Strowger equipment for all four exchanges has been manufactured and installed to the order of the British Post Office by the Automatic Telephone Manufacturing Co., Ltd.

United States.—RADIO-TELEGRAPHY.—The lease of the high-power transoceanic radio station at Sayville, Long Island, by the Postal Telegraph Company, the Commercial Cable Company, and the newly-formed Mackay Radio Company is an important step in ship-to-shore communication to compete with the existing organisations. World-wide communication such as is planned will mean combination of cable and radio services, each supplementing, but not necessarily supplanting, the other. The Trans-Pacific radio link between San Francisco and Honolulu will be completed this summer, and by the end of the year a link will be established with the Philippines. Simultaneously the Atlantic radio service between the entire Eastern coast of America and ships will have been gradually built up, and with the completion of the Pacific wireless stations the Mackay companies with Sayville as their base will have commenced an Atlantic radio service in competition with the existing agencies, says the *Daily Telegraph*, but it is not known which countries the Commercial Cable Company intends to approach in pursuance of its scheme for a trans-atlantic wireless service. The station at Sayville, Long Island, was originally operated by the German Telefunken Company, which built it in 1912, its chief purpose being to communicate with the station at Nauen. On July 15th, 1915, the U.S. Navy radio service took over the station.

TELEPHONE DEVELOPMENT. — An official estimate gives the number of telephones in the United States on December 31st last as 18,650,000, an increase during the past year of about 850,000 telephones. For purposes of comparison, the official estimate of the number of telephones in Great Britain is given as 1,635,000 (of which 1,600,000 are connected with the Post Office system), an increase of 124,000 for the year. The figures show that, although America possesses more than ten times as many telephones as Great Britain, she is still far from reaching saturation point. About 2,850,000 of the telephones in the United States are worked on the automatic principle, as against 171,000 in Great Britain.

Radio Notes.

Australia.—LICENCES.—The Postal Director, Mr. G. G. Haldane, has issued the following statement showing the number of licences in the various States:—

Victoria	133,746
New South Wales	72,162
Queensland	25,203
South Australia	18,645
Western Australia	3,911
Tasmania	3,343
Total for Commonwealth ...	257,010

The highest proportion of licence-holders to population is in Victoria (7.75 per cent.) and the lowest in Western Australia (1 per cent.). The average for the Commonwealth is 4 per cent. The total revenue collected from listeners for 1927-28 was £167,971.

Austria.—LICENCES.—Over 90 per cent. of the supporters of Ravag renewed their monthly subscriptions at the New Year, which binds them for the whole of 1928; only 80 per cent. was anticipated, says *World-Radio*.

B.B.C. Service. — BREAKDOWNS. — Evidence of technical efficiency is contained in the annual statement regarding the percentage of breakdowns at the B.B.C. stations. The total number of programme hours during the year (excluding Birmingham, 5GB) was 65,299, and the average hours per station 3,285. The percentage of breakdowns was .03, compared with .07 in 1926, and .09 in 1925. The actual duration of breakdowns during the year was 59 minutes. As Birmingham (5GB) is mainly an experimental station and therefore more liable to breakdowns, its figures are given separately. Its programme hours numbered 2,997, and its breakdown percentage was .56. Daventry (5XX) had the largest number of broadcast hours, the figure being 4,972, an average of 92¼ per week; its breakdown percentage was .07 (.09 in 1926). Other stations' figures were:—London (2LO), .02 (.22 in 1926); Manchester, .08 (.05 in 1926); Leeds, .02 (.02 in 1926); Cardiff, .003 (.001 in 1926), or one hour lost in 100,000, a record to be proud of.

Licence Income.—P.O. ACCOUNTS.—The Post Office's commercial accounts for the 12 months ended March 31st, 1927, show that for the nine months ended on that date the wireless receiving licences issued to the public produced £785,060; of that sum £620,000 is payable to the B.B.C., the balance accruing to H.M. Exchequer.

"PIRATES."—According to the *Daily Telegraph*, in its work of tracking down "pirates," the Post Office has adopted a method of "combing out" suspected areas throughout the country. Since October, 1925, there have been roughly 1,500 summonses, and in all but six instances fines were imposed. The total number of licences on January 1st, 1928, was 2,383,726, plus 11,000 free licences for blind listeners.

Spain.—INCREASE OF POWER.—It is reported that at the last meeting of the Council of Union Radio it was decided, in view of the numerous requests received, to start work on increasing the power of the Madrid and Bilbao stations. Authorisation to do so has been asked of the Technical Council for Radio Communication, and it is hoped that the work will soon be carried out. It appears that the power of the Madrid station will be doubled (from 6 kilowatts to 12), and that of the Bilbao station trebled (from 500 watts to 1.5 kilowatts).—*Reuter's Trade Service* (Madrid).

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—March 13th. Postmaster-General's Department. Motor generators. (B.X. 4136.)*
March 20th. Telephone receivers and parts. (B.X. 4135.)*
April 17th. Harbour Trust. Two 3-ton and two 5-ton semi-portal electric cargo cranes. (A.X. 5827.)*
SYDNEY.—February 20th. Electricity Department. Metal-filament electric lamps. (Spec. No. 1,219.) Construction Engineer, Electricity Department, Town Hall, Sydney.

Belfast.—February 7th. Northern Counties Committee, L.M. & S. Railway Co. Telegraph ironwork, wire, electric lamps, porous pots, &c. Specifications, &c., from Mr. F. J. Martin, stores superintendent, York Road station, Belfast.
February 18th. Electricity Department. Materials for 12 months, including cables, electrical accessories, meters, &c. (See this issue.)

Bury.—Board of Guardians. Electric lighting and heating installation at new nurses' home, Bury Infirmary. Specifications from Mr. G. J. Gibbs, consulting engineer, 7, Lime Street, Preston.

Cardiff.—February 24th. Electricity Department. E.h.p. and l.p. cables for 12 months. One 1,250-kW rotary convertor. (See this issue.)

Darlington.—February 13th. Electricity Department. One water-tube boiler, with mechanical stoker, economiser, air heater, chimney, &c. (January 27th.)

Dundee.—February 16th. Electricity Department. One 100-kVA indoor-type sub-station transformer, 3-core e.h.p. and 4-core l.p. cable. (January 27th.)

Edinburgh.—February 27th. Electricity Supply Department. Four steam-generating units, complete with mechanical stokers, economisers, air heaters, grit arrestors, chimneys, &c.; steam, water and dust extraction pipework and valves; one electrically-driven and two steam-driven boiler feed pumps. (January 20th.)
February 20th. One 1,000-kW motor convertor, three 1,000-kVA transformers, e.h.p. and l.p. switchgear. (See this issue.)

Edmonton.—February 14th. Urban District Council. Maintenance of the electric lighting installation at the Town Hall and offices, public baths, cleansing station, stores, mortuary and outbuildings, maternity centre, and public libraries, to include the supply of necessary materials for a period of 12 months. (See this issue.)

Gloucester.—February 20th. Electricity Department. Two 3,000-kVA transformers, nineteen 25-kVA ditto h.p. switchgear, &c. (See this issue.)

Greetland (near Halifax).—February 10th. Electric lighting installation at the Council school. Specification from Mr. P. H. Swire, Education Offices, Huddersfield Road, Elland.

Horsham.—February 4th. Electricity Department. One vertical Diesel oil engine (air injection type), direct coupled to a 625-kVA alternator and one 500-kW rotary convertor, with switchgear, pumps, and auxiliaries. (January 20th.)

Hull.—February 13th. Tramways Committee. General stores for 12 months, including lamps, cable, switches, overhead equipment material, &c. General manager, Tramway Offices, Albion Street.

Irish Free State.—DUBLIN.—February 9th. Office of Public Works. Electric lighting installation at the Four Courts, Dublin. Specification (£1) from the Office of Public Works, Dublin.

Leeds.—February 17th. Electricity Committee. Twelve months' supply of stores, including cables, jointing and insulating materials, &c. (January 27th.)

Leslie (Fifeshire).—February 6th. Town Council. Electric lighting installation for 40 houses. Specifications from Walker & Pride, architects, Church Street, St. Andrews.

London.—CENTRAL ELECTRICITY BOARD.—March 6th. 132-kV switchgear for outdoor transforming stations. (January 20th.)
METROPOLITAN ASYLUMS BOARD. February 22nd. Installation of automatic telephone and call bell systems at the Northern Fever Hospital, Winchmore Hill, N.21, and installation of electric bells at the Hostel, Little Gray's Inn Lane, E.C. (See this issue.)
HAMMERSMITH.—February 22nd. Electricity Committee. Stores for 12 months (including electric lighting sundries, joint boxes, meters, cables, &c.). (See this issue.)

CROWN AGENTS FOR THE COLONIES.—February 24th. Supply, installation and maintenance of sub-station plant and switchgear at Colombo, Ceylon. (See this issue.)

CAMBERWELL.—February 21st. Board of Guardians. Installation of a telephone system at Constance Road Institution, East Dulwich. (See this issue.)

Manchester.—February 6th. Electricity Committee. 250-, 500-, and 750-kVA static transformers. (January 27th.)

February 14th. Tramways Committee. Permanent-way points, tongues, and crossings and general stores, including :—Sched. A : Commutator segments, armature and field coils, switches, bells, cells, &c.; insulation material, overhead equipment material, circuit breakers (tramway type), lightning arrestors, electrodes for welding cable (power and lighting), bell wire. Schedules, &c., from Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly.

Nantwich.—February 23rd. Board of Guardians. Electric lighting installation for the Institution. Mr. G. P. Dennis, 66, South John Street, Liverpool. (Returnable deposit of £1 1s.)

New Zealand.—WELLINGTON.—March 21st. Post and Telegraph Department. Automatic telephone receivers. (B.X. 4143.)

May 25th. New Zealand Government Railways. Machine tools and workshop equipment. (A.X. 5823.)*

Oldham.—February 18th. Electricity Department. Steam, feed, exhaust, drain and condenser water pipes, boiler-feed pumps, feed and drain tanks, &c. (January 20th.)

Peru.—LIMA.—Flashing traffic beacons. (B.X. 4174.)*

Plymouth. — February 20th. Electricity Department. Electricity meters, cables, transformers, and sub-station switchgear. (January 27th.)

Portuguese East Africa.—LOURENCO MARQUES.—March 26th. Port and Railways Department. Two groups of motor pumps for Ressano Garcia water supply. (A.X. 5831.)*

Rumania.—GALATZ.—March 1st. Direction of Maritime Port Service, Constantza. Four 3-ton semi-portal cranes. (A.X. 5850.)*

Salford.—February 4th. Public Health Committee. Re-wiring of Nos. 139-145, Regent Road. Specifications from Medical Officer of Health, 143, Regent Road.

South Africa.—CAPE TOWN.—February 16th. Electricity Department. 11,000-V and 600-V cables. (B.X. 4146.)*

JOHANNESBURG.—February 16th. Town Council. Metal filament traction lamps. (B.X. 4160.)*

March 15th. South African Railways and Harbours. Four 25-ton electrically-driven overhead travelling cranes. (A.X. 5883.)*

February 16th. Municipal Council. Street lighting. (B.X. 4179.)*

March 1st. Truck-type cubicles. (B.X. 4180.)*

Stoke-on-Trent.—February 8th. Electricity Department. 12 months' supply of mains and cables; a.c. and d.c. meters; sub-station switchgear; static transformers. (January 27th.)

Swindon.—February 11th. Electricity Department. Telpher coal-conveying plant, &c. (January 20th.)

Uruguay.—MONTEVIDEO.—March 19th. State Electricity Works. Equipment for one main transformer station, five sub-transformer stations, two connection posts, and one inspection post with accessories and spares. (B.X. 4173.)*

Waterford.—February 18th. Electricity Supply Department. Three 120-kVA transformers, five 60-kVA ditto. (January 20th.)

York.—February 8th. Electricity Department. H.p. and l.p. paper-insulated cables. (January 20th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—SYDNEY.—The tender of the Government Dockyard at Walsh Island has been accepted for the construction of 100 railway carriages for the new electric system, the carriages to cost £4,076 each.—*Reuter* (Sydney).

Bradford.—Education Committee. Accepted:—
Electric lighting installation at the McMillan school, Thackley.—W. P. Holt & Co.

Brighton.—Lighting Committee. Accepted:—
Cables for street-lighting scheme :—

Standard Telephones and Cables, Ltd. (Accepted.)	**£5,015**
Siemens Bros. & Co., Ltd.	5,065
Callender's Cable & Construction Co., Ltd. ...	5,156
Pirelli-General Cable Works, Ltd.	5,211
British Insulated Cables, Ltd.	5,211
W. T. Glover & Co., Ltd.	5,213

Grimsby.—Electricity Committee. Recommended:—
Portable coal conveyor (£200).—C. H. Johnson & Sons.

Hastings.—Electricity Committee. Accepted:—
Additional plant for the Broomsgrove power station:—
One 6,250-kW turbo-alternator and condensing plant (£23,600, platform £300, foundations £350).—Brush Electrical Engineering Co., Ltd.
Water-tube boiler, with superheater, mechanical stokers, economisers and induced draught plant (£16,427).—Stirling Boiler Co., Ltd.

Hornsey.—Electricity Committee. Recommended:—
Meters.—Reason Manufacturing Co., Ltd.; Ferranti, Ltd.; and Chamberlain & Hookham, Ltd.
Time switches.—Venner Time Switches, Ltd.

Ilford.—Tramways Committee. Accepted:—
Two miles of trolley wire (9 11/16d. per lb.).—British Insulated Cables, Ltd.
Electricity Committee. Accepted :—
Automatic time switch at Goodmayes (£157).—Crompton-Parkinson, Ltd.
Cable (£235).—Union Cable Co., Ltd.

Irish Free State.—DUBLIN.—Controller of Stores, Department of Posts and Telegraphs.
Telephone cabinets.—T. R. Scott & Co.
Insulators.—W. F. Dennis & Co.; Goerz Bros. & Kellie, Ltd.; Herbert Price & Co.
Electric lamps.—Litton & Co., Ltd.; Siemens-Schuckert (Ireland), Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.; Siemens Electric Lamps and Supplies, Ltd.
Solder.—Wilbraham & Smith & Co., Ltd.
Telephone apparatus.—Phœnix Telephone & Electric Works, Ltd.; Telephone Manufacturing Co., Ltd.; Plessey Co. (1925), Ltd.; General Electric Co., Ltd.

Lamp Contract.—Metro-Vick Supplies, Ltd., has received a contract for "Cosmos" vacuum, tubular, and special lamps for the Admiralty.

London.—LONDON COUNTY COUNCIL.—Stores and Contracts Committee. Accepted :—
Electric insulating material for 12 months.—Attwater and Sons; Butterfield & Renton; Dacier, Ltd.; Hamnett & Andrew; J. N. Hardy & Son; Ioco Rubber and Waterproofing Co., Ltd.; Mica & Micanite Supplies, Ltd.; Pomona Rubber Co.; Micanite and Insulators Co., Ltd.; Rubber Industries, Ltd.; Siemens Bros. & Co., Ltd.

Highways Committee. Two electric lifts for the tramways central repair depôt :—

	Push-button control.	Controllers within cages.
†Marryat & Scott, Ltd.	£1,140	£1,128
Holt & Willetts. (Accepted.) ...	**1,240**	1,200
Herbert Morris, Ltd.	1,510	1,490
S. H. Heywood & Co., Ltd. ...	1,535	1,510
Hoisting Appliance Co.	1,550	1,510
Express Lift Co., Ltd.	1,624	1,605
Smith, Major & Stevens, Ltd.	1,704	1,630
Rawlinsons, Ltd.	1,930	1,920

† Not complete.

Morecambe.—Electricity Committee. Accepted:—
Switchgear for Regent Road and Middleton Lane sub-stations.—General Electric Co., Ltd.

Northampton.—Health Committee. Accepted:—
Electric lighting installation, Harborough Road hospital (£348).—E. W. Wood.

Reading.—Board of Guardians. Accepted:—
Installing electric lighting in the dining hall, &c., of the Institution (£97).—Callas, Sons & May, Ltd.

Salford.—Electricity Committee. Recommended:—
Erection of two Liptak flat double-suspension arches for boiler at Agecroft power station (£402).—Liptak Furnace Arches, Ltd.

Sheffield.—Electric Supply Committee. Accepted:—
Re-wiring four 1,000-kVA transformers (£876).—British Electric Transformer Co., Ltd.

Sittingbourne.—Urban Council. Accepted:—
Water-recording instruments (£290).—Telechron Electric Transmitter Co.

Forthcoming Events.

Junior Institution of Engineers.—Friday, February 3rd. 39, Victoria Street, S.W. 7.30 p.m. "Automatic Sub-Stations." Mr. D. Kingsbury.

Friday, February 10th. 39, Victoria Street, S.W. 7.30 p.m. "Some Principles of Investigation in Engineering Work." Prof. H. P. Philpot.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, February 4th. South Wales Institute of Engineers, Cardiff. 6 p.m. Ordinary meeting.

Institution of the Rubber Industry.—Monday, February 6th. Engineers' Club, W. 8 p.m. "Automatic Controls in Rubber Manufacturing Plant." Mr. H. C. Young.

Society of Engineers.—Monday, February 6th. Burlington House, W. 6 p.m. Presidential address by Mr. C. H. J. Clayton.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, February 6th. Institution, London, W.C. 7 p.m. "Domestic Water Heating." Mr. F. Selley.

Thursday, February 9th. Hotel Cecil, Strand, W.C. 7 for 7.30 p.m. Annual dinner.

(North Midland Centre).—Tuesday, February 7th. Hotel Metropole, Leeds. 7 p.m. "Stability of Large Power Stations." Mr. F. H. Clough.

(North-Western Centre).—Friday, February 10th. Joint meeting with the Manchester Association of Engineers, Milton Hall, Manchester. 7 p.m. "Inspection Methods." Mr. E. J. Parish.

(Dundee Sub-Centre).—Thursday, February 9th. University College, Dundee. 7.30 p.m. "Development of the Rotary Convertor." Mr. J. Conway.

(East Midland Sub-Centre).—Tuesday, February 7th. The College, Loughborough. 6.45 p.m. "Modern Reaction Turbines." C. D. Gibb.

(Scottish Students' Section).—Wednesday, February 8th. Royal Technical College, Glasgow. 7.30 p.m. Smoking concert.

Association of Supervising Electrical Engineers.—Tuesday, February 7th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Electrical Equipment of Warships." Mr. W. McClelland.

Institution of Engineers-in-Charge.—Wednesday, February 8th. St. Bride Institute, E.C.4. 7.30 p.m. "Some Notes on Engine and Boiler House Accessories." Mr. J. J. Martin.

Institute of Fuel.—Wednesday, February 8th. Burlington House, W. 6 p.m. "The Use of Thermal Storage in Industry." Mr. S. Hopkins.

Electrical Trades Benevolent Institution. — Wednesday, February 8th. Trocadero. Festival dinner.

Royal Society of Arts.—Wednesday, February 8th. John Street, Adelphi, W.C. 8 p.m. "Theatre Lighting." Mr. H. D. Wilkinson.

Overhead Lines Association.—Wednesday, February 8th. Institution of Electrical Engineers, Savoy Place, W.C.2. 5.30 p.m. Discussion of proposed amendments to regulations.

Electrical Power Engineers' Association (Manchester Section).—Thursday, February 9th. Geographical Hall, Manchester. 7 p.m. "The Law Relating to Compensation in Case of Accidents." Mr. J. W. Thomas.

Royal Institution of Great Britain.—Thursday, February 9th. 21, Albemarle Street, W.1. 5.15 p.m. "From Faraday's Note Books." Sir Wm. Bragg, F.R.S. (Lecture II.)

Physical Society.—Friday, February 10th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Electrical Engineers' Ball.—Friday, February 10th. Hotel Cecil.

British Electrical and Allied Industries Research Association.—Friday, February 10th. Savoy Hotel. 12.45 p.m. for 1 p.m. Luncheon.

Illuminating Engineering Society.—Friday, February 10th. Annual dinner.

Electrical Trades Commercial Travellers' Association.—Friday, February 10th. Connaught Rooms, London, W.C. Annual dinner.

Notes.

Automatic Boiler Regulation.

In the article under the above heading in our issue of January 13th, fig. 3 was incorrectly described as the "operation indicator." It actually illustrates the Roto reciprocating valve which is used for controlling the steam to stoker engines or steam-driven fans.

E.A.W. Activities.

The following lectures have been arranged by the Committee of Women Demonstrators of the Electrical Association for Women, to be held at the E.L.M.A. Lighting Service Bureau, London, at 7.0 p.m.: February 16th, "Electric Bells, Indicators, Batteries, &c., by Mr. W. C. Jeary; February 28th, "Food Preservation and Refrigeration," by Mr. A. H. Hunter; March 13th, open discussion on "Electric Cookers," by Mrs. Pearmain, Miss Metton, and others; March 27th, "Some Difficulties in Dealing with Consumers," by Miss de Gruchy. On January 31st, Miss Q. F. Coppen lectured on "Domestic Electric Water Heating."

The following lectures have been specially arranged for cooks and are to be held at 46, Kensington Court, W.8, at 3 p.m.: February 13th, "The Construction and Control of an Electric Cooker," by Miss Dorothy Vaughan; February 20th, "The Principles of Electric Cooking," also by Miss Vaughan; February 27th, "The Preservation of Food," by Mr. A. H. Hunter.

Members of the South Wales and Monmouthshire branch of the Association recently visited Veritas House, Frederick Street, Cardiff, as the guests of Mr. G. Falk and Mr. E. Thomas, when they were addressed by Mr. C. G. Morley New, the city electrical engineer.

The Ashford (Kent) Electric Development Circle, consisting of the contractors of the town working in conjunction with the Electricity Department, held a meeting on January 25th, with the object of starting a local branch of the Electrical Association for Women. About 200 of the townspeople met in a tastefully decorated hall with electrical exhibits, and after tea listened to speeches from Mr. G. S. Francis, of the E.D.A., and Miss Haslett, of the E.A.W. About 40 members were enrolled, a result considered very satisfactory by all concerned. The meeting was followed by an entertainment and inspection of cooking apparatus.

The I.E.E. Benevolent Fund.

On Tuesday last week the play "Rosemary" was performed at the Rudolph Steiner Hall, London, in the presence of a large and appreciative audience. The accompanying

A Scene from "Rosemary."

illustration shows one of the scenes; the producer, Mr. Cuthbert Andrews, is seen standing on the right, and Lieut.-Col. Kenelm Edgcumbe, who organised the performance, seated in the centre. The result was a contribution of £70 to the Fund.

The "M.E.T.A." Dinner.

The second annual dinner of the Meter Engineers' Technical Association was held at the Engineers' Club, London, on Saturday last, when Mr. G. F. Shotter, president of the Association, took the chair.

After the loyal toast, Mr. A. M. Sillar, M.I.E.E., president, Association of Supervising Electrical Engineers, proposed "The M.E.T.A." He compared the multiplicity of regulations with which the meter engineer had to contend in the electrical industry with the few obtaining in the gas industry. As chairman of the B.E.S.A. Committee for the proposed new specification for meters, he congratulated the Association on having eleven members on the committee, and paid a tribute to the members for their work in that connection. He urged upon the members of the Association the necessity of "passing along" information as to their professional experiences.

In reply, Mr. Shotter said that the membership of the Association had increased since the last dinner from 136 to 250. The Association was more than ever necessary, and the severe demands of the new specification would enhance its value. The quality of the papers read before the Association was now higher, and he thought the papers would compare well with those of the senior institutions.

In proposing "The Visitors," Mr. E. E. Sharp, of Venner Time Switches, Ltd., said he thought the time must come when membership of the Association would be necessary for a man to get a good meter job. In referring to the suggestion that there were too many engineering associations in existence, he said that the Institution of Electrical Engineers could not do the necessary work and the M.E.T.A. had justified its existence.

Councillor G. Catchpole, ex-Mayor of Bermondsey, in reply, stressed the fact that meter accuracy was an asset to both the supply undertaking and the consumer. He said that the Bermondsey electrical exhibition six months ago was unique in its meter exhibit, and the stall had been a great help to the undertaking. Bermondsey was putting on an average of 50 consumers weekly. He was struck by the friendly atmosphere in the Association.

Capt. L. J. Loughingham, *Electrical Times*, referred to the excellent relations between the Association and the electrical Press. With regard to the doubts that had been expressed as to the necessity of the Association, he thought that the suggestion which had been made with regard to the I.E.E. might arise again.

Major A. E. Pells proposed "Absent Members."

The Quest for the Perfect Clock.

The following letter has been received from Mr. F. Hope-Jones, M.I.E.E., F.R.A.S.:—

May I contribute a postscript to the interesting correspondence which recently appeared in your columns on this subject?

It appears in *Nature* of January 21st, where Professor W. de Sitter, of Leyden, discusses the rotation of the earth and astronomical time.

He deals at length with the lack of constancy in the ratios of the day, month, and year, and points out that we have no means of knowing whether the month gets shorter, or the day gets longer, or both. He discusses the motions of the heavenly bodies relatively to the motion of the earth as if they were clocks with inconsistent rates, and concludes with some interesting speculations as to what contribution the "Synchronome" free pendulum will make to astronomical knowledge, as follows:—

"The manufacture of precise clocks made great strides in the nineteenth century, but still, not many years ago, astronomers used to get rather uneasy when, as a consequence of bad weather, they had to rely on their clocks for any length of time, say a week or a fortnight.

The invention of the free-pendulum clock has suddenly altered the aspect of the problem. One of these clocks has been left entirely to itself, being, however, kept under rigorous observation at the Observatory at Greenwich during the greater part of the year, and its rate has been absolutely invariable (apart from a very slight retardation due to a slow lengthening of its pendulum by sagging to the extent of, if I remember rightly, something like a fifth of a micron per month). It looks as if this clock could be depended on to keep time within a few hundredths of a second for a period measured in years instead of weeks.

Can then, these wonderful clocks, if this expectation should turn out to be confirmed, be of use as a control on the uniformity of astronomical time like the motion of the moon, the sun, and the planets? Can the handiwork of man compete with the heavenly bodies?"

Appointments Vacant.

Assistant sales engineer for the Bristol Corporation Electricity Department; consulting electrical engineer for the Wolverhampton Education Committee; general manager and chief engineer for the Cannock U.D.C. Electricity Undertaking. Two wiremen for the Cornwall Mental Hospital, Bodmin. Electricians for the Plympton St. Mary R.D.C. Assistant mains engineer for the Corporation of Lincoln Electricity Department. Meter tester and repairer (87s. 5d.) for the Borough of Bermondsey Electricity Works. Engineers for Hopkinsons, Ltd. (See our advertisement pages to-day.)

Electric Storage Heating.

The application of electricity in heating water for domestic purposes was discussed by Professor S. Parker Smith, D.Sc., M.I.E.E., at a lecture held under the ægis of Edinburgh Electrical Society in the Philosophical Institution, Edinburgh, on January 19th, according to the *Evening Dispatch*. Professor Smith said that one particular inducement to employ electricity in heating water was the fact that certain municipal electricity undertakings gave favourable tariffs for night load consumption. The whole matter would be irrational and absurd were a tariff other than the ordinary not given. The lecturer admitted that water could be heated by a coke boiler more cheaply than by electricity, but the trouble of refuelling the coke boiler had to be taken into consideration. He advocated heating panels being placed at suitable points in the ceilings of rooms, so that an even temperature might be maintained. These panels, he stated, were heated through the day by water which had been electrically heated during the night at the small tariff charge, and stored until required. The present household tanks could be converted, but it was preferable to install a copper tank. The tank should be coated on the outside with 2½in. of cork, which gave 90 per cent. efficiency. In the course of the subsequent discussion it was stated that the Glasgow night tariff was three-eighths of a penny per unit. Edinburgh had no night tariff at the present time, but there was a very favourable combined rate—five-eighths of a penny per unit.

Problems in Illuminating Engineering.

At the meeting of the Illuminating Engineering Society held at the House of the Royal Society of Arts on January 24th, the president (Mr. D. R. Wilson) gave a short address referring to the great loss sustained by the Society in the sudden death of its founder and hon. secretary, Mr. Leon Gaster. The address was followed by a resolution recording this loss with deep regret, and expressing grateful appreciation of Mr. Gaster's invaluable services, not only to the Society, but to the cause of illuminating engineering throughout the world. The president then announced that the Council had invited Mr. J. S. Dow to become hon. secretary for the time being, and Mr. Dow briefly expressed his appreciation of this mark of confidence. He recalled that he had been associated with Mr. Gaster for more than 20 years.

After the president had explained that, owing to the death of Mr. Gaster, the annual dinner had been postponed, a series of short contributions dealing with "Problems in Illuminating Engineering" was presented.

The first item was a contribution from Mr. S. G. Elliott (Underground Railways, Ltd.) dealing with "Escalator Lighting." Mr. Elliott showed lantern slides illustrating the various methods that had been tried at different times, pointing out their merits and drawbacks. He concluded with several illustrations showing the new indirect lighting on the escalator at Waterloo station, which appears to be answering well. The indirect units are mounted on standards on the woodwork between the two staircases, the height being carefully selected so that persons using the escalator see practically no direct light.

Mr. A. Cunnington (Southern Railway) then discussed some problems in foundry lighting. The problem is rendered difficult by the very low reflecting power of the materials used, necessitating a very high illumination, and by the tendency of lighting fittings to become dirty. Originally lighting from the side was adopted, but the present system is based on the use of a series of flood-lights mounted in the highest part of the roof. In these circumstances the tendency to collect dust is less, and it is a considerable advantage to have the fittings well out of the range of view.

Mr. H. C. Weston (investigator to the Industrial Fatigue Research Board) dealt with the use of magnifying glasses in certain processes involving very fine work. It was not always realised by workers that inability to distinguish fine detail might be due to imperfections of vision rather than inadequate illumination. The first step was to see that workers in need of glasses received their help, and next to ensure that the illumination answered requirements.

Mr. C. E. Greenslade discussed a somewhat curious problem that had arisen in connection with daylight illumination. Although there was little obstruction to the light, and the room appeared to be well illuminated, occupants were conscious of discomfort during hours of natural lighting, though the artificial illumination was apparently quite satisfactory. It was ultimately found that the painting, with white paint, of the roof of an adjacent shed, so that light was reflected inward on to the ceiling of the room, had a very beneficial effect.

Mr. J. S. Dow gave a brief account of the lighting of the new Holland tunnel, forming a highway between Manhattan Island and New Jersey, in the United States. A feature of the lighting was the use of lamps behind diffusing glass and recessed in the walls of the tunnel, so that there was a clear view along its length.

The president announced that the next meeting would take place at the E.L.M.A. Lighting Service Bureau on February 28th, when an account of its activities would be given by Mr. W. E. Bush. Reference was also made to the forthcoming discussion on "Road Traffic Signs," arranged by the Institution of Public Lighting Engineers at the Bureau on February 21st.

Electric Baking Ovens.

Referring to the report on p. 173 of our last issue, Mr. T. Settle, M.I.E.E., informs us that, contrary to our statement, he said he was strongly opposed to the conversion to electric heating of existing ovens.

Educational.

A course of ten lectures and demonstrations on the "Electrical Equipment of Motor Vehicles" will be given at the Borough Polytechnic, Borough Road, S.E.1, on Thursday evenings, from 8 to 9.30 p.m., commencing on February 9th next. This course will be suitable for those engaged in the manufacture, maintenance, repair or running of motor vehicles. Further particulars may be obtained from the principal.

Institution Notes.

Institution of Electrical Engineers.

INFORMAL MEETING. — At the informal meeting held on January 23rd, Mr. M. Whitgift in the chair, there was an interesting discussion on "Power Factor Correction." Mr. C. S. Buyers said that power factor was becoming for many undertakings a serious question, owing chiefly to the large increase in the number of small induction motors installed, and the high capital cost of new mains. He believed the phase advancer was no longer manufactured in this country. The first cost of salient-pole synchronous motors or rotary condensers in the larger sizes was less than for static condensers, but the running losses were rather high (5 per cent.). In America they were used in sizes up to 50,000 kVA, usually with automatic control of the voltage or power factor. The synchronous induction or autosynchronous motor was by far the most popular and convenient method of correcting power factor, as the motor without extra complication developed useful power and at the same time corrected the power factor of itself and of other inductive machinery on the same circuit.

Mr. E. W. Dorey, speaking on the static condenser, said that it was often the best method because of its high efficiency, not requiring any attention or special switching, so that it was now installed in very large numbers along with the transformers upon poles of e.h.p. overhead lines. A number of slides of rotary and static apparatus were shown, and in many cases the particular duty was described.

NORTH-MIDLAND CENTRE.—The Faraday Lecture entitled "Electricity in the Service of Man" was delivered by Dr. S. Z. de Ferranti, F.R.S., at the Albert Hall, Leeds, on January 24th, when Mr. W. B. Woodhouse presided over an enthusiastic audience of nearly 1,000 persons. Dr. Ferranti appealed to the imagination of his audience, and received hearty applause at the conclusion of the meeting.

Institute of Transport.

A meeting of the Institute will be held at 18, George Street, Edinburgh, at 7.30 p.m. on February 14th, to inaugurate a Scottish section. The president (Mr. Roger T. Smith) will attend the meeting and deliver an address. Members of all classes of the Institute and other transport officials resident or engaged in Scotland are cordially invited to be present. Further particulars can be obtained from the acting secretary of the section, Mr. R. Stuart Pilcher, M.Inst.T., manager of the Edinburgh Corporation tramways and motors.

Junior Institution of Engineers.

In a paper read before the Institution on January 27th, on the subject of "Powdered Fuel Firing for Boilers," Mr. R. H. Allen, B.Sc., considered the possible advantages of powdered fuel under the headings of steam cost, output, reliability, flexibility, range of fuels, and smoke. Mr. Allen said that at present there was a straight fight between stokers and powdered fuel, but at a later date it might become a three-cornered contest between those two systems, and the complete gasification of fuel before combustion. He made a critical examination of the combustion problems of powdered fuel and indicated their complexity. He said that the following expedients might be adopted to accelerate combustion: (1) finer grinding; (2) preheated air; (3) maximum possible turbulence to produce high relative velocity between coal and air. The first method was too costly; the second possibly too destructive for higher temperatures to be used than at present; the question of turbulence was by far the most important. It was noteworthy that practically all the largest installations until quite recently had been fired on the long-flame principle, which actually reduced turbulence to a minimum. Turbulent burners were being used for the new Hams Hall station at Birmingham. The powdered-fuel system had decided advantages by way of increasing the output of existing plants, and the limits to the amount of coal which could be burnt with water-cooled walls and a high degree of turbulence had not yet been found. That the use of coal in powdered form did offer real advantages was proved by repeat orders from those who had previous experience with stoker plants, but even then it had to be remembered that there had been considerable recent improvements in the technique of stoker firing.

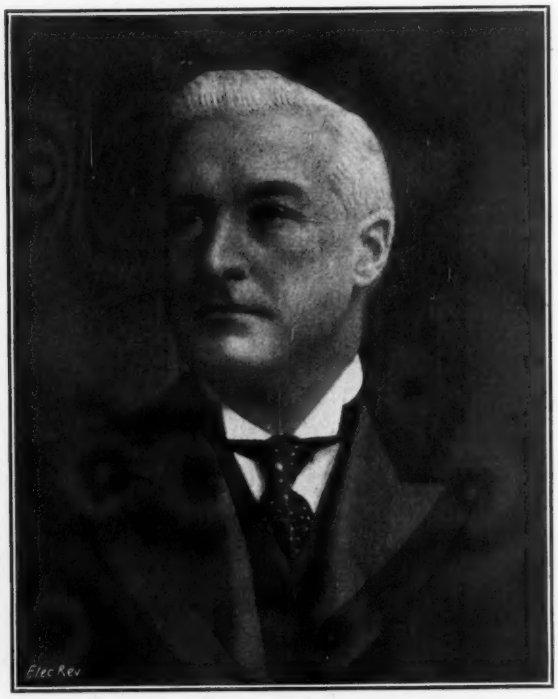
Iron and Steel Institute.

The annual meeting of the Institute will be held on May 3rd and 4th next at the Institution of Civil Engineers, Great George Street, S.W.1, when Mr. Benjamin Talbot will assume office as the president for the year 1928-29; the meeting will take place under his presidency. The annual dinner will be held on May 3rd at the Connaught Rooms, Great Queen Street, W.C.2. By kind invitation of the members of the Institute resident in Bilbao and the neighbouring mining districts, the autumn meeting will be held at Bilbao during the week commencing September 24th.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

In our last issue there appeared an article upon electricity supply in London in which the activities of the London Power Company were dealt with. We are now able to reproduce a portrait of Mr. WILLIAM FRANCIS FLADGATE, M.V.O., J.P., the chairman of the company. Mr. Fladgate was born in 1853 and was educated at Harrow. In 1890 he joined the board of the Electricity Supply Corporation, Ltd., a company



Mr. W. F. Fladgate, M.V.O., J.P.,
Chairman of the London Power Co., Ltd.

formed to acquire the small generating station which had been established by Messrs. A. & S. Gatti, and in the same year he became chairman of the company which is now known as the Charing Cross Electricity Supply Co., Ltd., and he still holds that position. Mr. Fladgate has always been one of the principal movers in the direction of joint action between the London electricity supply companies. In 1908 he took part as chairman of the Charing Cross Company in the promotion of a Bill by nine of the London companies which eventually became the London Electric Supply Act, 1908. At the same time five other company undertakers in London were promoting a practically similar Bill which became the London (Westminster and Kensington) Electric Supply Companies' Act, 1908. Both Acts had essentially in view united action between groups of companies instead of isolated action by single companies. In 1905 the chairmen of the thirteen London companies and the Central Electric Supply Company united as the Conference of Directors of the London Electric Supply Companies; Mr. Fladgate was elected chairman, a position which he has retained ever since. When the companies were submitting to the Electricity Commissioners their ideas as to a general scheme for London, in 1921, Mr. Fladgate took the leading part on the administrative side in propounding a scheme which was put forward by ten of the London companies acting together under the title of the London Electricity Joint Committee (1920), Ltd. This committee later on became the London Power Company, Ltd., as it now exists. It was this company that promoted the Bill of 1922, which eventually was passed as the London Electricity (No. 2) Act, 1925. The status of the London Power Company is fully recognised in the Electricity Supply Act, 1926, and it now carries on its functions under the Central Electricity Board with the powers and limitations of that Act, and it is not too much to say that Mr. Fladgate's original ideas of co-operation and co-ordination have been substantially carried out by the Act of 1926. During all these years of discussion and controversy Mr. Fladgate has taken an active and leading position; indeed, it has been largely owing to his personal tact in dealing with the companies concerned, that the close and friendly union among them has been brought about. Mr. Fladgate is an old and distinguished member of the Garrick Club, of which his father was for many years a member. He succeeded his father as honorary solicitor to the Charing Cross Hospital, and has held that position for a great number of years. He is a past vice-president of the Incorporated Law Society. Mr. Fladgate has always taken a very great interest in his old school and was chairman of the Executive Committee of the Harrow School War Memorial, for which upwards of £50,000 was raised.

The Lancaster Electricity Committee has recommended the Council to increase the salary of Major G. C. MILNES, M.C., who has been electrical engineer since 1910. Major Milnes was reported to have been a candidate for the Grimsby engineership; and Coun. R. Roberts (chairman of the Lancaster Committee) said it was most important that they should retain Major Milnes's services, as they were pledged to an expenditure of £114,000 within a short period. He moved that Major Milnes's salary be increased to £805, and thence according to the scale of the A.M.E.E. The Council agreed to the increase by 15 votes to 6.

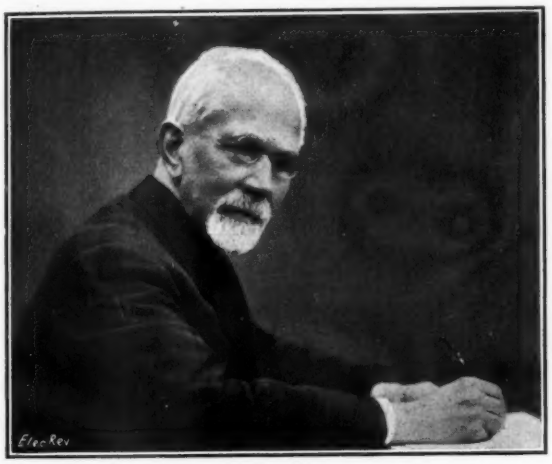
In July last Mr. LEONARD H. MATTHEWS, a plumber-jointer in the Hammersmith Electricity Department, rescued a fellow-employé who accidentally came into contact with live high-

pressure switchgear at an electricity sub-station at the Post Office Savings Bank, Blythe Road, and met his death as the result. The Mayor inaugurated a "Hero Matthews" Fund, and this amounted at the date of a recent meeting to £210. In the minutes of the Council it is now reported that the trustees of the Carnegie Hero Fund Trust have decided to inscribe Mr. Matthews's name on their Roll of Heroes and to award his widow £1 per week and a Memorial Certificate.

On January 25th, at Wood Lane Works, Mr. C. M. BENNETT, M.I.E.E., late chief engineer to the Kensington and Notting Hill Electric Lighting Companies' Joint Undertaking, was presented with a gold cigarette case by the employés. The gift was inspired by a sense of affection, and regret at Mr. Bennett's severance from Wood Lane works.

Mr. F. G. HOLDEN has tendered his resignation of the position of borough electrical engineer and manager at Scarborough. It will take effect as from March 31st. Mr. Holden is to be appointed consulting electrical engineer from April 1st at £150 per annum for a period not exceeding five years.

Sixty years' service with one firm is the rare achievement of Mr. C. J. PALMER, whose portrait accompanies this note. Mr. Palmer joined the firm of Ransomes & Sims as an apprentice in 1868. Since the completion of his apprenticeship he has served in various departments of the business which has long been known as Ransomes, Sims & Jefferies, Ltd. In March Mr. Palmer is retiring, and the opportunity was recently



Mr. C. J. Palmer,
Who has been with "Ransomes" for 60 years.

taken to mark his parting from the company in a suitable way. Mr. W. M. Burch presented him with a gold watch and a pocket wallet, and several of his colleagues paid tribute to his energy and ability. In acknowledging the presentation, Mr. Palmer reviewed the history of the concern in a very interesting manner, and spoke of his pleasant associations with past and present members of the company.

Brevet Lieut.-Col. N. H. FIRMIN, O.B.E., T.D., who has recently been promoted from major, commands the Tyne Electrical Engineers (T.A.), and is personal assistant to Mr. R. P. Sloan, C.B.E., chairman and managing director of the Newcastle-upon-Tyne Electric Supply Co., Ltd.

The Wigan Town Council has appointed Mr. THOMAS BARTON as chief assistant mains engineer at the electricity works. Mr. Barton was formerly chief testing engineer to Messrs. Ferguson, Pailin, Ltd., and has been research engineer to Messrs. W. T. Glover, Ltd

Mr. JOHN SHANNON has left the Paisley Corporation Electricity Department after nine years' service, and has joined Messrs. Simplex Conduits, Ltd. The Paisley staff presented him with a suit-case.

On Saturday last Mr. E. DINSDALE PHILLIPS, consulting engineer, Manchester—founder and editor of that very interesting journal, *The Mining Electrical Engineer*, and district officer for the N.W. area in the C.E.D.A.C. campaign—celebrated his silver wedding.

Mr. W. A. KNIGHT, who has retired from the electrical engineering staff at Portsmouth Dockyard after 40 years' service with the Admiralty, has been presented by his colleagues with a wireless set.

It is announced that Sir JOHN F. C. SNELL, chairman of the Electricity Commission, has been elected president of the British Electrical and Allied Industries Research Association for the ensuing year.

Mr. JOSEPH BOYCE, who has been borough electrical engineer of Morecambe since 1919, is leaving to take up a similar position at Cleethorpes. After a wide experience with private companies, Mr. Boyce entered the municipal side of electrical engineering as deputy borough electrical engineer and tramways manager of Darwen. He resigned this post to become borough electrical engineer of Todmorden, where he put in hand a £100,000 extension scheme, and modernised the electricity department.

The Ilford Corporation Electricity Committee recommends that the salary of the deputy borough electrical engineer, Mr. G. F. GREGORY, be increased by £50 per annum, rising by a further annual increment of £25 to a maximum of £700 per annum.

Mr. J. R. RICHARDSON has been appointed assistant to Mr. Ernest Pickbourn, chief representative in the Midlands and East Anglia for the Electrical Equipment & Carbon Co., Ltd.

The Liverpool Electricity Committee recently recommended that Mr. P. J. ROBINSON, acting city electrical engineer, should be appointed city electrical engineer.

Obituary.—MR. W. C. MOUNTAIN.—It is with feelings of deep regret that we have to record the death of Mr. William Charles Mountain, J.P., M.I.Mech.E., M.I.Min.E., M.I.E.E., &c., the well-known consulting electrical, mechanical and mining engineer, who was for so many years a partner in the firm of Ernest Scott & Mountain, manufacturers of electrical machinery, especially for use in mining equipment. Mr. Mountain passed away on January 26th, at his residence, 8, Sydenham Terrace, Newcastle-on-Tyne, at the age of 66 years. We shall refer more fully to his work and career in our next issue. The funeral took place at Jesmond on Monday.

Wills.—The late Sir ALFRED DENT, formerly chairman of the Shanghai Electric Construction Co., Ltd., left £61,962.

Mr. HERBERT GEORGE CAKEBREAD, A.M.I.E.E., of Alexandra Park, N., left £4,922.

The late Mr. W. E. JONES, a director of Bayliss, Jones and Bayliss, left £157,480 gross, and £157,017 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Axuel Time Switches, Ltd.—Private company. Registered January 18th. Capital, £3,000 in £1 shares. Objects:—To acquire from C. Houselander the benefit of the patent for Great Britain and Northern Ireland in respect of a certain invention described as "Improved Clockwork Operated Electric Time Switches," patent No. 725/27, and the equivalent for the U.S.A., serial No. 233,265, together with other like patents abroad as and when obtained; also to acquire that part of the business of Pelhams, Ltd., now connected with the patent aforesaid, which patent has been produced and marketed in one of its uses as the "Axuel" radio programme selector, and to carry on the business of electrical, mechanical, and general engineers, &c. The permanent directors are:—F. N. Wilson, 54, The Avenue, Ealing, W.13; G. P. Hancock, 13, Rosebery Gardens, Crouch End, N.8; H. M. Goodale, "Harma," Northumberland Road, North Harrow, Middlesex (managing director, Pelhams, Ltd.). Secretary: H. M. Goodale. Registered office: 5, Banner Street. Bunhill Row, E.C.1.

Charles Mason (Newcastle-upon-Tyne), Ltd.—Private company. Registered January 23rd. Capital, £3,000 in £1 shares. Objects:—To acquire the business of an electrical, motor, mechanical, and general engineer now carried on by C. H. Mason at 16, Saville Row, Newcastle-on-Tyne, as "Charles H. Mason." The permanent directors are:—C. H. Mason, 16, Saville Row, Newcastle-upon-Tyne, engineer; H. Wilcock, 13, Burn Avenue, Forest Hall, Northumberland, engineer. Qualification, 200 shares. Solicitors: C. D. Forster & Lester, 24, Grainger Street West, Newcastle-upon-Tyne.

Electric Factors (Blackpool), Ltd.—Private company. Registered January 21st. Capital, £500 in £1 shares. Objects:—To carry on the business of manufacturers of, and dealers in, electrical materials, goods and appliances, electrical and other automobile accessories, &c. The first directors are: H. Gilpin, "The Chalet," Carleton, Blackpool, theatrical producer; G. Gilpin, "Hermisten," Stanah Road, Thornton-le-Fylde, electrical engineer. Solicitor: J. M. Dickinson, 46, Abingdon Street, Blackpool.

Associated Battery and Magneto Co. (Glasgow), Ltd.—Private company. Registered in Edinburgh January 20th. Capital, £300 in £1 shares. Objects:—To acquire the business of the Associated Magneto Co. and to carry on the business of battery and magneto manufacturers, &c. The subscribers (each with one share) are:—R. G. Gammon, 100, York Drive, Hyndland, Glasgow, engineer; Mrs. L. G. Gammon, 100, York Drive, Hyndland, Glasgow. The first directors are not named. Registered office: 101, West Nile Street, Glasgow.

The Association of Public Lighting Engineers.—Registered on January 21st as a company limited by guarantee, not having a share capital. The income and property of the Association, whencesoever derived, is to be applied solely towards the promotion of its objects, and the word "limited" is omitted from the title by licence of the Board of Trade. For the purpose of registration, the number of members is declared to be 150. In the event of winding up, each member is liable for such sum as may be required, not exceeding £1. The objects are to promote, encourage, and improve the science of efficient public lighting and to facilitate the exchange of information and ideas on that subject among the members of the Association; to hold meetings, to print and publish reports and papers, &c. The management is vested in a council. Registered office: 68, Victoria Street, S.W.1.

Hall Telephone Accessories (1928), Ltd.—Registered as a "public" company on January 21st with a nominal capital of £140,000 in 10s. shares. The objects are to acquire the business of Hall Telephone Accessories, Ltd. (in liquidation), and to carry on the business of dealers in telephone apparatus of all kinds, automatic and other telephone collecting boxes, automatic stamp and ticket vending machinery, and wireless requisites, marine, electrical and general engineers, manufacturers' agents, &c. The minimum cash subscription is £7. The first directors (to number not fewer than three or more than seven) are:—The Hon. Oscar M. Guest, 75, Sussex Gardens, W.2, director of Guests' Trust, Ltd.; F. W. Hall, 21, Bolton Gardens, S.W.5, engineer; the Hon. Edward C. Pery, D.S.O., 10, Evelyn Gardens, S.W.7, stockbroker; the Hon. Lionel G. W. Guest, 26, Connaught Square, W.2, director of Guests' Trust, Ltd., who shall hold office until the ordinary meeting in 1931. Qualification, £100. Remuneration, £100 each per annum (£150 for the chairman), and (collectively) 10 per cent. of any amount by which the net profits of any year exceed the sum required to pay 10 per cent. dividend. Registered office: 115, Old Broad Street, E.C.

William Allan & Co. (Liverpool), Ltd.—Private company. Registered January 27th. Capital, £3,000 in £1 shares. Objects:—To acquire the business of electrical adaptor manufacturers, wireless factors, forwarding and manufacturers' agents, &c., now carried on by W. A. Eastaway and Mrs. W. Eastaway at 62, Dale Street, Liverpool, as "William Allan and Co." The permanent directors are:—W. A. Eastaway, "Derryogue," Queen's Drive, Mossley Hill, Liverpool; A. Hudson, 2, Lyon Street, Garston, Liverpool. Secretary: H. Mason. Registered office: 62, Dale Street, Liverpool.

Tanleys, Ltd.—Private company. Registered January 27th. Capital, £1,500 in £1 shares (1,000 participating preference and 500 ordinary). Objects:—To carry on the business of manufacturers' agents and general sales representatives, electricians, manufacturers and distributors of electricity. The first directors (to number not fewer than two or more than seven) are:—H. M. Winstanley, "The Cedars," Bray, Berks., engineer; N. Secretan, 60, Fairlop Road, Leytonstone, engineer.

Official Returns of Electrical Companies.

Electricity Distribution of North Wales and District, Ltd.—Capital, £205 500 in 200,000 preference shares of £1 each and 110 000 ordinary shares of 1s. each. Return dated May 18th (filed July 27th), 1927. 150,000 preference and 110,000 ordinary shares taken up. £152,000 paid on 150,000 preference and 40,000 ordinary shares. £3,500 considered as paid on 70,000 ordinary shares. Mortgages and charges, £150,000.

Electrical Contracting Co. (Tamworth), Ltd.—Capital, £500 in £1 shares. Return dated September 27th, 1927. 325 shares taken up. £245 paid. £80 considered as paid. Mortgages and charges nil.

Minehead Electric Supply Co., Ltd.—Trust deed dated December 31st, 1927, to secure £20,000 debenture stock, charged on leasehold property at Marsh Lane, Alcombe, Somerset, and the company's other assets, present and future, including uncalled capital. Trustees: H. D. Leather, East Parade Chambers, Leeds, and F. Risdon, Williton, Somerset.

Brundall and District Service Co., Ltd.—Capital, £10,000 in £1 shares (increased from £4,000 on October 24th, 1927). Return dated October 22nd, 1927. 4,000 shares taken up. £3,750 paid. £250 considered as paid. Mortgages and charges at date of return, £1,500; since registered series of debentures for £4,000, all issued October 31st, 1927. Return of allotments, made up to October 31st, 1927, shows a further 1,175 ordinary shares allotted for each, and fully called up.

A. W. Penrose & Co., Ltd.—Capital, £45,000 in 15,000 preference and 30,000 ordinary shares of £1 each. Return dated July 14th, 1927. 10,500 preference and 30,000 ordinary shares taken up. £10,507 paid. £29,993 considered as paid. Mortgages and charges, £1,300.

Hampson Bros., Ltd.—Satisfaction in full on August 12th, 1927, of mortgage dated October 26th, 1925, securing £5,700. (Notice filed January 18th, 1928.)

Julius Sax & Co., Ltd.—Capital, £10,000 in 3,000 7½ per cent. preference shares of £1 each, and 35,000 ordinary shares of 4s. each. Return dated October 21st, 1927. 2,650 preference and 18,000 ordinary shares taken up. £5,051 paid on 2,650 preference and 12,005 ordinary shares, £1,199 considered as paid on 5,995 ordinary shares. Mortgages and charges, nil.

Weston-super-Mare and District Electric Supply Co., Ltd.—Capital, £100,000 in 40,000 preference and 60,000 ordinary shares of £1 each. Return dated June 13th, 1927. All shares taken up. £100,000 paid. Mortgages and charges, £37,500.

Currys (1927), Ltd.—Five mortgages, four dated January 11th and one dated January 14th, 1928, to secure £1,950, £1,725, £1,650, £1,800, and £1,500, and any further advances respectively, charged on properties in Cowley, Oxon, Kettering, Portsmouth, Chester, and Hitchen. Holders: Bradford Third Equitable Benefit Building Society, 48, Market Street, Bradford.

Sadia, Ltd.—Particulars filed of £2,000 debentures and premium of 10 per cent. authorised January 13th, 1928, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Ferranti, Ltd.—Capital, £300,000 in 100,000 6 per cent. preference, 100,000 7 per cent. second preference, and 100,000 ordinary shares of £1 each. Return dated November 3rd, 1927. 71,166 6 per cent. preference, 75,000 7 per cent. preference, and 60,000 ordinary shares taken up. £206,166 considered as paid. Mortgages and charges, £45,441.

Tubes, Ltd.—Capital, £215,000 in £1 shares. Return dated November 11th, 1927. All shares taken up. £107,584 paid (being £1 per share on 82,859 shares and 10s. per share on 49,450 shares), £107,416 considered as paid (being £1 per share on 82,691 shares, and 10s. per share on 49,450 shares). Mortgages and charges, nil.

Stensigns (1927), Ltd.—Capital, £5,000 in £1 shares. Return of allotments, made up to October 19th, 1927, shows 3,037 shares allotted, payable in cash and fully called up. Mortgages and charges, nil.

Southern Brazil Electric Co., Ltd.—Capital, £507,800 in 182,800 10 per cent. cumulative preference shares of £1 each, and 650,000 ordinary shares of 10s. each. Return dated January 4th, 1928. All shares taken up. £3 10s. paid on seven ordinary shares, £507,796 10s. considered as paid on the remainder. Mortgages and charges: £879,950.

Synchronome Co., Ltd.—Capital, £2,000 in 600 preference and 1,400 ordinary shares of £1 each. Return dated September 23rd, 1926 (filed September 19th, 1927). All shares taken up. £700 paid, £1,300 considered as paid. Mortgages and charges, nil.

Electro-Metals, Ltd.—Capital, £30,000 in 4,000 preference shares of £5 each and 10,000 ordinary shares of £1 each. Return dated September 8th, 1927. 102 preference and 10,000 ordinary shares taken up. £510 paid, £10,000 considered as paid. Mortgages and charges, nil.

City Notes.

Amalgamated Wireless (Australasia), Ltd.

The accounts for the year ended June 30th last show a profit of about £25,000, double that of the previous year. During the year the capital was increased by £80,000. Since the close of the year the "beam" service has reached a position in which working expenses are covered by the revenue; the profits of the service will be available to the company. The Commonwealth Government is subsidising the coastal stations. With regard to broadcasting, an agreement has been reached by which, in return for the free use of its patent rights, the company will receive 3s. in respect of each broadcasting licensee.

Metropolitan Railway Co.

A final divident of 2 per cent. is to be paid on the ordinary stock, making 3 per cent for the year, as in 1926, when the reserves were drawn upon. £10 000 is transferred to reserve and about £26,500 is carried forward.

The final dividend on the surplus lands stock is 2½ per cent. maintaining the rate for the year at 3¾ per cent.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Stock Exchange Committee under Rule 159:—

American Telephone and Telegraph.—$3,285,000 capital stock in shares of $100 each.

Hall Telephone Accessories (1928).—280,000 shares of 10s. each, fully paid, Nos. 1 to 280,000.

The undermentioned have been ordered to be officially quoted:—

American Telephone and Telegraph Co.—$3,285,000 capital stock.

Shawinigan Water and Power Co.—100,000 shares of common stock of no par value.

Southern Electric Tramways Co. of Buenos Aires.—£130,000 6½ per cent. first mortgage debentures, Nos. 1 to 1,300 (£100).

Chatham and District Light Railways Co.

The report for the year ended December 31st last shows a revenue of £72,362 and a gross balance of £13,722. After paying rental and income tax, reserving £4,500 for depreciation, and crediting interest received and £962 brought forward, there is a disposable balance of £6,159. The preference dividend is paid, and a dividend of 2½ per cent. is recommended on the ordinary shares, leaving £1,259 to be carried forward. Reference is made in the report to the intense motor-omnibus competition, and the hope is expressed that the authorities all over the country will take steps to restrict licences to the reasonable requirements of the districts served. Meeting: February 6th.

Fife Tramway, Light and Power Co., Ltd.

The trading profits of the undertakings owned and operated by the company for the year ended December 31st last amounted to £104,386, and a balance of £77,878 was paid to the company. After meeting expenses, there was a profit of £76,748 (including £6,144 brought forward), as compared with £64,042 in 1926. The debenture interest, &c., is paid and £5,186 is transferred to reserve. It is proposed to pay a dividend of 4 per cent. (against 3 per cent.) on the ordinary shares and to carry forward £5,253. Meeting: To-day (Friday).

Adelaide Electric Supply Co., Ltd.

The gross revenue for the year ended August 31st, 1927, was £765,023, as compared with £670,877 in the preceding year. After meeting operating expenses and taxation there remains a net revenue of £412,616 (against £374,895). The cost of share issues is written off and debenture interest paid, leaving £310,995. It is intended to place £100,000 to reserve and £10,000 to dividend-equalisation account. The ordinary dividend is maintained at 12 per cent., and £24,709 is carried forward. During the year 250,000 6½ per cent. preference shares and a similar number of 8 per cent. preferred ordinary shares were issued at par, raising the paid-up capital to £2,729,687.

Westinghouse Brake & Saxby Signal Co., Ltd.

The accounts for the year ended September 30th last show a net profit of £107,117 (against £130,311) after crediting dividends received and meeting working expenses, depreciation, debenture interest, &c. To this is added £10,255 brought forward, making £117,372. Of this, £10,000 is placed for special purposes to depreciation reserve, and £10,000 to general reserve, and after the payment of a dividend of 8 per cent. (as for 1925-26) a balance of £7,582 is carried forward.

Dublin United Tramways Co., Ltd.

Out of the profits for the past year the directors propose to pay a final ordinary dividend at the rate of 5 per cent. per annum, making 4½ per cent. for the year (against 5½ per cent.). £50,000 is to be set aside for track renewal and £15,000 for mortgage and debenture redemption fund.

Boulton & Paul, Ltd.

The net profit for the past year was £16,670; in the preceding year there was a loss of £4,893. An ordinary dividend of 2½ per cent. (against nil) is being paid, £3,000 is transferred to income tax reserve, £4,980 to general reserve, and £17,218 is carried forward.

Western Union Telegraph Co.

The earnings report for the year ended December 31st last (December figures estimated) shows a gross revenue of $134,246,561, as compared with $136,406,026 in 1926. The total expenses fell from $118,774,832 to $115,602,382, and the net income from $15,205,049 to $15,059,848.

Cable, Telephone and General Trust, Ltd.

For the half-year ended December 31st last the directors have declared the dividend on the 6 per cent. cumulative preference shares, and one at the rate of 7 per cent. on the "A" preference shares for the past year.

Morgan Crucible Co., Ltd.

This company is to acquire shares in the Universal Grinding Wheel Co., Ltd., and appoint two members to its board. The Grinding Wheel Co. is increasing its capital from £100,000 to £225,000.

Enfield Cable Works, Ltd.

An interim dividend of 5 per cent., payable February 11th, has been declared on the ordinary shares (as last year).

German Companies.

The *Siemens and Halske Company* reports net profits and balance forward amounting to 18,851,000 marks for the year ended September 30th, 1927, comparing with 15,348,000 marks in 1925-26. It is proposed to pay a dividend of 12 per cent. (against 10 per cent.), to place 5,000,000 marks to the special reserve fund (2,500,000 marks), and to carry forward 2,516,000 marks (2,450,000 marks).

The *Siemens-Schuckert Works Company*, which was converted into a share company in July, 1927, has issued its accounts for the year ended September 30th, 1927. The accounts show a net profit of 14,780,000 marks, as compared with 12,175,000 marks in the previous year. A dividend of 9 per cent. is being paid on the share capital of 120,000,000 marks, against 8½ per cent. on the partnership capital of 90,000,000 marks in 1925-26, including interest at the rate of 7½ per cent. on the non-determinable loan of 30,000,000 marks. A sum of 3,000,000 marks has been transferred to the special reserve fund and 980,000 marks is carried forward.

Allgemeine Elektricitäts Gesellschaft.—The gross profit for the year ended September 30th last amounted to 17,300,000 marks, as compared with 14,600,000 marks in 1925-26. The net profit rose from 10,700,000 to 12,300,000 marks, and the dividend is raised from 7 to 8 per cent. The report states that the turnover during the year increased by over 40 per cent., and at the close of the period the uncompleted orders in hand were 70 per cent. higher than on October 1st, 1926.

City of Buenos Ayres Tramways (1904), Ltd.

A final dividend of 1s. 3d. per share is recommended, making 5 per cent. for the year ended December 31st last as for 1926. It is proposed to place £10,000 to amortisation and general fund and to carry forward £2,884.

Elliott's Metal Co., Ltd.

It is announced that as more than 75 per cent. of the shareholders have accepted an offer to exchange their holdings for shares in Imperial Chemical Industries, Ltd., the necessary arrangements are being made to carry this into effect.

Stocks and Shares.

MONDAY EVENING.

WITH the exception of gilt-edged securities which were inclined to dullness, things round the House were on a much more active scale than a week ago. The industrial market again showed its ability to provide spectacular movements. For example, a newcomer this week (Duophone 10s. ordinary) started at 14s. 6d. on Tuesday, and finished up at 32s. on Friday evening: Not bad going for three days! ! The heavy contango rates charged this time on some of the more popular of the industrial counters has disclosed a fairly heavy bull position which will probably result in a certain amount of heaviness as the account draws to a close. The Metropolitan Railway dividend was about what was expected. Business in this stock has been quieter than of late, and the price has moved within very narrow limits. The same can be said of Undergrounds, both ordinary and income stock, although there has been a good deal of business, especially in the ordinaries, which are being persistently recommended for lock-up purposes.

Electricity—at Home.

The reports of practically all the home electric light companies make their appearance during the early part of the year and are being looked forward to, this time, with more than ordinary interest. The results for 1926 were, of course, adversely affected by the industrial troubles of that year and the consequent rise in the price of fuel. In spite of these drawbacks, the companies which had to reduce ordinary dividends can be counted on the fingers of one hand. This being so, shareholders and the market alike, are looking forward, not without reason, to considerably improved results when the figures for 1927 are available. As a result there has been quite a steady pull for the ordinaries of practically all of the larger lighting companies. Yorkshires have been in favour, marking up to 33s. 9d., as were Counties, Newcastles, Midland Counties, Shropshires, and Lancashires. Owing to shortage of debenture stocks of this group the preference shares have been in investment demand. The "Sixes," such as County of London, North Metropolitan, and Yorkshire, are all (within a few pence) on the same basis, *i.e.*, 23s., giving a yield of just on 5½ per cent. There are a few 4½ per cent. preference shares of some of the London companies available (Charing Cross and Metropolitans, for example), and here the price is 17s. 9d. to 18s. Two new electric lighting debentures are expected in the near future, one of a distributing company in the Home Counties and the other of a well-known Colonial concern. The honour of being the first in the field with the figures for 1927 fell to the Fife Tramways, Light & Power Co., Ltd., whose report and accounts were in shareholders' hands over the week-end. Profits showed an appreciable increase over the previous year and the dividend is raised from 3 per cent. to 4 per cent. The shares hardened up to 16s. in consequence. Edmundson's, which have been fairly quiet at about 45s. all the week, suddenly jumped this morning to 53s. on buying which appears to emanate from the provinces.

—and Abroad.

The feature here was again Atlas Light & Power ordinary. Persistent buying raised the price at one time to 20s., from which there was a slight reaction to 19s. 6d. Sphere Investment Trust (late United Electric Tramways of Montevideo, Ltd.), which holds a large block of Atlas ordinary, rose some 2s. to 19s. 3d. Another active spot was the 6 per cent. sterling debentures of the Tokyo Electric Company, which have been bid up to 96 as against 89 a few days ago. Whitehall Electric Investment 7½ per cent. preference responded to purchases, and are 3d. to the good at 21s. 7½d. The 6 per cent. debenture was also harder at 103. There was a fair amount doing in Perak River Hydro-Electric ordinary at 14s. 9d., and the 7 per cent. participating debentures at 105½ x.d. have been in demand. The conditions attaching to this stock are rather peculiar. The company has no power to repay but has to accumulate by 1951, by means of a sinking fund, a capital sum equal to the outstanding debentures, and every individual holder has the right, any time after June, 1951, to demand payment at 105. It boils down to this, that eventually stock holders will be holding a stock in perpetuity, giving a minimum of 7 per cent. and a maximum of 9 per cent. per annum with their capital available for them the moment they care to take it. This stock is being quietly absorbed by persons investing for a long lock-up. Among the smaller concerns Kalgoorlie Power & Lighting 10s. ordinary have advanced to 9s., a rise of 1s. 3d. Mexican Light common are unchanged. The preference have been weak, and though nominally 77-81, have marked as low as 76.

Tramways.

It is understood that the main line railways have agreed in principle to come into the proposed London Traffic Pool so far as their suburban lines are concerned. This caused a little more speculative interest to be taken in the London tramway companies. Both London United Tramway and London and Suburban Traction preferences left off 8s. bid with the ordinaries in each case about 2s. 6d. Lancashire United Transport ordinaries have again been in demand on the approach of the report, which is due in about a fortnight from now. At 9s. 9d. they are 2s. up on the week. The 6 per cent. debenture hardened in sympathy to 96½. Another bright spot was Potteries Electric Traction 6 per cent. preference, which at 7s. 3d. also gained 1s. The ordinary remained stationary at 4s. British Electric Traction junior stocks were unchanged, but both the debentures, which do not often come to market, were dealt in; the 5 per cent. at 98 and the 4½ per cent. at 80. There was a little more activity in the preference shares of the Anglo-Argentine Tramways Company which resulted in a gain of 3/16th for the 5½ per cent. preference and ¼th for the 6 per cent. 2nd preference. The 5 per cent. debenture stock was also better at 78½. British Columbia Electric Railway stocks show no change from the previous week's quotation. The Barcelona Traction common dividend announcement created a little investment inquiry for the 6½ per cent. prior lien bonds at round about 103½. Brazil Traction common at 205 are 14 points down, a result of their shedding their "rights" and dividend during the week. Mexico Tramways, in common with most things Mexican, were dullish. A share very rarely seen, United Electric Tramways of Caracas ordinary, changed hands on the basis of 14s. 6d. to 14s. 9d.

Cables.

Marconis have again been the star turn, occupying the centre of the stage with a vengance. Starting at 51s. 6d., the price steadily forged ahead each day, closing at 57s. 6d. this evening, after not quite touching the £3 mark. The preference have also risen and the 6½ per cent. convertible debenture stock is 160 upward, a rise of some 25 points. Rather peculiarly, both Marconi Marines and Canadian Marconis at 37s. 9d. and 15s. respectively, are practically unchanged. The submarine cable shares, although not displaying anything like the vitality of the Marconi family, received a good deal of support, and were a very healthy market in consequence. Eastern Extensions and Globe ordinary, at 16, are both 10s. up, and Eastern Telegraph are 5 points better at 150. Automatic Telephones are also higher at 48s.

Manufacturing.

Johnson & Phillips were a bright spot in the electrical equipment section, marking up to 53s. 3d., although the shares only "go out" 2½-2¾. Siemens at 30s. 6d. are 6d. to the good and General Electric at 35s. are 1s. up. Metropolitan-Vickers were also harder. Enfield Cable 7½ per cent. preference at 26s. 3d. are 2s. 6d. up; quite a big rise for a fixed dividend share. Another fixed dividend share in demand was the 6 per cent. preferred ordinary of Crompton-Parkinson, which appreciated 1s. to 17s. 6d. British Electric Transformer ordinary and preference have been active, as have Babcock & Wilcox and British Aluminium ordinary, without, however, altering the quotation in any instance. The Westinghouse Brake report made its appearance during the week and was, in the opinion of the market, as disappointing as the dividend announcement which preceded it. Dealers cannot understand why, in a year free from industrial trouble, profits should be actually less than for 1926, and the chairman's speech is being looked forward to with no little interest. The shares left off at 28s., about 1s. 6d. down. Consolidated Signals, which hold a large block of Westinghouse Brake shares, sagged off to 35s. on the appearance of the Westinghouse report, but afterwards recovered to 40s. on the announcement of their own dividend of 12½ per cent., as against 10 per cent. previously.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Jan. 30 1928.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£1	14†	14†	60/6	—	4 12 10
Brompton Ordinary	£1	10	8⅝	25/-	—	5 12 0
Charing Cross Ordinary	£1	15	8½	26/-	—	5 7 8
do. do. 4½% Pref.	£1	4½	4½	17/6	—	5 2 10
Chelsea	£1	12	8⅞	25/6	—	5 9 10
City of London	£1	15	10	30/-	—	4 13 4
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Clyde Valley	£1	8	8	32/-	—	5 0 0
County of London	£1	15	7½	29/6	+6d.	4 14 11
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	£1	8	10	52/-xd	+7/-	3 16 11
do. 7% Pref.	£1	7	7	25/6xd	—	5 9 10
Elec. Supply Corporation	£1	11	11	35/-	—	6 5 9
Kensington Ordinary	£1	15	8	26/-	—	5 7 8
Lancs. Light and Power	£1	7½	7½	27/-	—	5 11 1
London Electric	£1	10	8½	25/6	—	5 9 10
do. do. 6% Pref.	£5	6	6	5½	—	5 8 2
Metropolitan	£1	11	8	30/-	—	4 13 4
do. 4½% Pref.	£1	4½	4½	17/-	—	5 8 6
Midland Counties	£1	6	6	24/-	—	5 0 10
Newcastle-on-Tyne Ordinary	£1	7	5	28/9	—	4 4 3
do. 5% Pref.	£1	5	5	18/-	+6d.	5 10 0
do. 7% Pref.	£1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	£10	6	6	10½	—	5 11 7
North Met. Elec. 6% Pref.	£1	6	6	23/-	+6d.	5 4 4
St. James' and Pall Mall	£5	17½	8	27/-	—	5 3 8
South London	£1	15	8½	25/6	—	5 9 10
South Metropolitan Pref.	£1	7	7	1¼	—	6 3 0
Urban Ordinary	£1	7	7	40/-	—	3 10 0
do. 6% Pref.	£1	6	6	1⅛	—	5 13 0
Westminster Ordinary	£1	15	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	21/7½	+3d.	6 18 9
Yorkshire Elec.	£1	8	8	33/-	—	4 17 0
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	74	—	5 8 1
Metropolitan	,,	5	3	70	—	4 5 9
do. District	,,	3½	3½	69½	+½	4 8 1
Underground Electric	£1	Nil	1½	21/9	+1½	1 7 7
do. do. Income	Bonds	6	6	109	—	5 10 1
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	99xd	—1	6 1 2
do Def.	,,	1½	1½	23½xd	—¾	6 7 8
Automatic Telephone	£1	3	10	48/-	+1/9	4 3 4
Chili Telephone	£5	5	6	7⅞	—	3 18 3
Eastern Extension	£10	10	10	16	+½	*6 1 3
Eastern Tel. Ord.	Stock	10	10	150	+5	*6 13 4
Globe Tel. and T. Ord.	£10	10	10	16	—½	*6 5 0
do. do. Pref.	£10	6	6	10½	—	5 4 6
Great Northern Tel.	£10	20	20	39	—	5 2 7
Indo-European	£6	8½	10	35	—	*6 1 5
Marconi	10/-	Nil	5	57/6	+6/-	1 14 10
Marconi-Marine	£1	7½	8¾	37/9	—	4 12 8
Oriental Telephone Ord.	£1	12	12	51/3	—	*4 13 6
United R. Plate Tel.	£5	8	8	10½	—½	*3 18 1
Western Telegraph	£10	10	10	15	—	*6 13 4
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	8¾	+3/16	7 6 8
do. do. 2nd Pref.	£5	6	6	8¾	—⅛	8 0 0
do. do. 5% Deb.	Stock	5	5	78½	+3	6 7 5
British Electric Traction Def. Ord.	,,	—	—	500	—	... ...
do. do. 8% Pref. Ord.	,,	7	8	124½	—	6 8 6
Brazil Traction	£100	5	6	205xr	—14	2 18 6
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	93½	—	5 6 11
do. do. Preferred	,,	6½	6½	156	—	*4 0 2
do. do. Deferred	,,	8	8	195½	—	*4 1 10
do. do. Deb.	,,	4½	4½	84½	—	5 0 7
London & Sub. Trac. 5% Pref.	£1	Nil	Nil	8/-	—	... ...
London United Tram Deb.	Stock	4	4	55½	—	7 4 2
Mexico Trams, 5% Bonds	—	5	5	78	+2	6 9 4
Mexican Light Common	£100	Nil	Nil	62	—	... ...
do. Pref.	£100	Nil	Nil	79	—1	... ...
do. 1st Bonds	—	5	5	82½	—	6 4 0
Yorkshire (West Riding)	£1	5	—	7/6	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	£1	13	13	64/3	—	4 1 3
British Aluminium Ord.	£1	12½	10	50/-	—	4 0 0
British Elec. Transformer Pref.	£1	7	7	18/3	—	7 13 6
British Insulated Ord.	£1	15	15	4½	—	3 12 8
Brush Ord.	£1	10	10	30/-	—	6 13 4
Callenders	£1	15	15	3 1/2	—	3 16 4
do. 6½% Pref.	£1	6½	6½	23/-	—	5 9 5
Crompton Parkinson Pref. Ord.	£1	—	—	17/6	+1/-	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	89	—	5 12 4
Electric Construction	£1	10	7½	25/-	—	6 0 0
Enfield Cable Pref.	£1	7½	7½	26/3	+2/6	5 14 3
English Electric	£1	Nil	Nil	9/6	—	... ...
do. do. Pref.	£1	6	3	12/6	—	... ...
Gen. Elec. Pref.	£1	6½	6½	24/-	—	5 8 4
do. Ord.	£1	7½	7½	35/-	+1/-	4 5 9
Henley	£1	20	25	102/6	—	4 17 8
do. 4½% Pref.	£5	4½	4½	4¼	—	5 6 0
India-Rubber	£1	5	Nil	13/9	—	... ...
Johnson & Phillips	£1	17½	12½	51/9	—	4 15 10
Met.-Vickers Ord.	£1	8	8	30/-	—	5 6 8
do. Pref.	£2	8	8	2⅞	—	6 4 8
Siemens Ord.	£1	7	7½	30/6	+6	4 18 4
Telegraph Construction	£12	10	10	2½	—	*4 14 1

* Dividends paid free of Income Tax.
† 4% of which was Tax Free.

Australian Trade and Industry.

Effects of the Customs Tariff.

MR. R. W. DALTON, Senior Trade Commissioner in Australia, has furnished his annual report to the Department of Overseas Trade (Stationery Office, 3s. net). In a review of the general conditions in the Commonwealth, he says that a further period of prosperity has been experienced, except in Queensland, where there was a drought. The official figures of trade during 1926-27 show that imports reached a higher level than ever before, not excepting the "boom" year 1920-21. It is considered, however, that the activity in trade has been due to an appreciable extent to the heavy Government borrowings, and not to increased production and sale of Australian products. Australia's great resources and her capacity to improve them are sufficient to justify her indebtedness and assure her future. Another trade stimulant has been the rapid development of the instalment system, regarding the soundness of which opinion is divided.

The bulk of the report is naturally devoted to a survey of the agricultural industries. A section dealing with mineral production shows that during 1925 the value of copper produced was £756,628, the lowest in the past five years; in 1923 the value of production was £1,245,836. Low prices ruling at certain periods have rendered the working of some mines unprofitable. The production of tin in 1925 was the highest since 1920, the value being given as £752,909.

Manufacturing Industries and Tariffs.

The development of manufacturing industries in Australia has steadily proceeded. The number of factories (employing four or more people) rose from 20,795 in 1924-25 to 21,195 in 1925-26; the number of hands employed from 439,949 to 459,949; and the value of output from £380,843,986 to £400,342,398. The growth of electrical power used has been most noteworthy, this form of power having increased from one-sixth of the total in 1913 to one-third in 1924-25; steam power has continued to increase considerably, but the increase in the use of gas and oil engines is negligible. In the "metal works, machinery, &c." class there were 2,600 factories in 1924-25, with an output valued at £76,250,772. "Heat, light and power" occupied 448 "factories," and the value of the output was £16,493,752.

There is a feeling of uncertainty as to whether the policy of protection has secured to Australian industries the advantages which it was intended to secure. The manufacturers say that the continued increase of wages negatives the effect of duties. They ask, therefore, that any wage increases in future shall be accompanied by an immediate increase of an equivalent amount in the protection accorded by the tariff. The Prime Minister has pointed out the impracticability of this procedure: "If Australia were to go forward on a basis where costs of production became so high that the tariff became almost useless in building up industry, it would reach a point where economically its whole system of protection would fall to the ground." As regards efficiency of production, Mr. G. A. Julius, chairman of the Council of Scientific and Industrial Research, has stated that the output per person is no better to-day than it was 15 years ago. The general tendency is towards the multiplication of small factories which leads to inefficiency.

The report states that in the last Customs tariff revision more severe treatment was given to certain classes of electrical goods. The Customs Department has very wide powers to admit, or refuse to admit, free of duty machines of a class not made in Australia which are required by local industries. The Department takes active steps to find out not only whether the machinery is actually made in Australia, but whether it can be made there. It is not uncommon for the Department to attempt to bring together prospective purchasers and Australian manufacturers to allow the latter to quote even though they may not have made the particular kind of machine required. Furthermore, in most cases where free admission is granted, the importer has to give an undertaking to allow Australian manufacturers to examine the machinery with a view to future production of similar plant.

Electrical Imports.

Electrical machinery and appliances probably form the most important part of the machinery section, and the movements in the trade during the period under review are of particular interest because of the heavy increases in duty on certain lines imposed in the revision of the tariff. These increases caused a falling off in imports in some sections of the trade, and this was enhanced by "sentimental" preference shown by Australian buyers. In 1925-26 electric storage batteries were shown separately in the statistics for the first time. The total value was £328,729, of which £179,174 was attributed to the United Kingdom and £130,226 to the United States. There was an increase in the imports of telegraph and telephone cable, almost all of which came from the United Kingdom. The trade in dynamo-electric machinery was maintained, and Great Britain kept the lead, although her share was slightly reduced. The imports of electrical fittings fell off slightly, owing to smaller purchases from the United States. Lamp imports increased, and it is noteworthy that Great Britain's share increased while Holland's contracted. There were important decreases in measuring and recording instruments, control apparatus, transformers, telephones and unenumerated appliances. There was a large increase in the imports of telephone switchboards from the United States. During 1926-27 there was a heavy increase in the imports of electrical machinery and appliances. It is shown that the share of Germany in the imports of electrical machinery rose from £11,796 in 1922-23 to £66,317 in 1925-26. The imports of X-ray apparatus during 1925-26 were valued at £33,597, of which the United States provided £25,452 and Great Britain £3,418.

Austrian Developments.

Continued Recovery.

MR. O. S. PHILLPOTTS, O.B.E., Commercial Secretary at Vienna, has prepared a report, dated October, 1927, for the Department of Overseas Trade (Stationery Office, 1s. 6d. net). The introduction to the report says that the past year has seen a distinct acceleration in the pace of Austria's recovery. The state finances appear to be satisfactory, and since the summer of 1926 there has been a marked change for the better in industrial conditions. Both imports and exports declined in 1926; the adverse trade balance, although large, was less than in 1925. The exports of iron and metal goods made a poor showing, but certain other classes improved considerably.

Foreign Electrical Trade.

Appendixes to the report show that during 1926 electrical machines, apparatus, &c., to the value of 33,940,000 schillinge (£1,020,000), as compared with 29,109,000 sch. (£870,000) in 1925. The imports of radio apparatus in 1926 aggregated 20 tons, of which 3 tons came from the United Kingdom, Germany supplying the bulk of the remainder. The exports of "electrical machines and apparatus, electrotechnical necessities" during 1926 were valued at 58,780,000 sch. (£1,763,400), as compared with 58,804,000 sch. (£1,764,120) in 1925. These exports included 20,390,000 electric lamps, the bulk of which went to Germany and 1,898,000 to the United Kingdom; and 108 tons of wireless apparatus, of which 11 tons was exported to the United Kingdom and the greater part of the remainder to Germany and Czecho-Slovakia.

Hydro-Electric Development.

The rapid progress made in the development of Austrian water power has created a new export industry—the sale of electricity to Germany. Small amounts of power are at present transmitted from the provinces of Salzburg, Tyrol and Vorarlberg to Bavaria, but some much larger schemes are in progress or prospect in which German capital is participating. A contract between the Tyrolese Water Power Co. and a Bavarian company provides for the supply of 48 million kWh annually from the Achensee works. This quantity will be doubled when the second stage of the works is completed this year. A Westphalian power company is now in negotiation with Tyrol for the supply of large quantities of energy for the Rhine and Ruhr industrial districts, and the Germans have offered to finance the construction of new works on the Inn in Western Tyrol. They are already doing this in Vorarlberg in the case of works which will supply electricity to Wurtemburg. Preliminary concessions have been given to a Berlin bank for the construction of large works on the Enns River which would yield 120,000 h.p., and also for the distribution of electricity in the Burgenland. Opposition has been raised to the German control of any Austrian water power, as it is feared that the provision of German plant might be insisted upon to the detriment of the home industry. Since the war, up to the end of 1926, 71 hydro-electric works, aggregating 124,000 h.p. (mean), have been completed. There are 18 works under construction, which will provide 115,000 h.p., raising the total Austrian development to 440,000 h.p. It is proposed to develop 1,800,000 h.p. ultimately, one-half of the available power. At present the requirements of the country appear to be satisfied, and the soundness of a project for the development of 150,000 h.p. from the Danube is doubted.

Railway Electrification.

The electrification of the western part of the Austrian Federal Railways, begun six years ago, has proceeded so far that electric trains are now running from Innsbruck to Buchs and Bregenz on the Swiss frontier, and to Kufstein on the German frontier. Electric traffic across Austria from Germany to Italy will shortly commence running, *via* Kufstein, through the conversion of the line from Innsbruck to the Brenner Pass. The electrification of the line from Wörgl to Salzburg has been commenced; this will complete the second stage of the programme, and the total length of electrified main line will then be 622 km. It is stated that Austria would convert the line from Vienna to the Hungarian frontier if the Hungarian portion of the Budapest-Vienna line was elec-

trified. The management of the railways is reluctant to proceed with further schemes, stating that the cost is such that electrification cannot compete with cheap coal treated by modern methods. The bulk of the cost of electrification has been met out of the League of Nations loan, and the equipment has been made almost entirely in Austria.

Broadcasting.

As befits such a musical nation, the proportion of registered broadcast listeners to population (300,000 out of 6½ millions) is the highest on the Continent. Austria has five stations, and two others are projected. The manufacture of radio goods has developed rapidly, and the value of exports is now four times greater than that of imports; most of the exported apparatus goes to Germany and the Succession States. British exports to Austria consist chiefly of loud speakers and high-class specialities; the position with regard to certain other goods is complicated by patent questions. Austria is most important as an intermediary between this country and neighbouring States which have no radio industry of their own.

General.

Mr. Phillpotts says that, in common with other highly-industrialised countries, Austria requires more finished goods from abroad than would be expected. Although its population is smaller, the country imports more British manufactured goods than the neighbouring Succession States, and the market has great possibilities of expansion. The high quality of British goods is recognised, but British manufacturers and merchants must do their part by developing their selling organisations. It is noted that the higher duties recently introduced affect electrical goods, but the report does not definitely state the extent.

Norwegian Imports.

IN the following statement are shown the imports during 1925 and 1926 of electrical and allied material into Norway, together with a note of increases or decreases in value. The countries of origin of certain groups of apparatus are given, but the official statistics, on which the statement is based, do not give this information in many instances.

	1925. 1,000 Kroner.	1926. 1,000 Kroner.	Inc. or dec. 1,000 Kroner.
Internal combustion engines and electric motors valued each at	2,440	2,292	– 148
(1) less than 1,500 kr.	1,105	819	– 286
(2) 1,500 kr. or more	1,556	1,151	– 405
Total of above	5,101	5,038*	– 63
From Sweden	1,534	1,713	+ 179
„ Denmark	556	417	– 139
„ Germany	1,794	1,872	+ 78
„ United States	696	553	– 143
Electric generators and transformers valued each at	2,767	776	–1,991
(1) less than 3,000 kr.	213	150	– 63
(2) 3,000 kr. or more	672	217	– 455
Switchgear, &c.	248	177	– 71
Convertors (rotary)	603	246	– 357
Other electrical machinery and apparatus of a kind not manufactured in Norway	2,029	1,308	– 721
Lampholders with or without switches†	212	117	– 95
Switches, &c., for household purposes—			
Total	417	275	– 142
From Germany	380	228	– 152
Other electrical machinery and apparatus of a kind manufactured in Norway—			
Total	1,352	1,250	– 102
From United States	166	121	– 45
„ Sweden	625	574	– 51
„ Denmark	142	128	– 14
„ Germany	346	356	+ 10
Carbon brushes—			
Total	115	86	– 29
From Sweden	23	11	– 12
„ Germany	38	29	– 9
„ Great Britain	28	25	– 3
„ France	17	8	– 9
Electric cable and wire—†			
(1) lead covered	3,575	1,407	–2,168
(2) other, insulated	1,155	555	– 600
Total	4,730	1,962	–2,768
Accumulators and parts	789	636	– 153
Batteries and parts	894	561	– 333
Electric lamps	3,259	1,861	–1,398
Electrical apparatus (including telephone and telegraph) ...	2,493	1,529	– 964
Electric meters	337	172	– 165

* Includes generators in this year. † Mainly from Germany.

Trade Prospects.

The Views of Some Leading Authorities.

AT this time of the year the annual meetings of the shareholders of the big banks take place, and a great deal of publicity is given to the speeches of the chairmen. Many of the points made by the speakers are of interest, and we refer to some of them below.

A part of the address by Mr. R. H. Tennant at the Westminster Bank meeting was devoted to a consideration of the hire-purchase system. He said that although a great deal of the trade of the United States had been attributed to this system, it was doubtful if more than 5 per cent. of the total credit employed in trade was so attributable, and the estimates of various American authorities had even suggested a figure as low as 2 per cent. The application of the scheme in British conditions required careful consideration. The United States had not yet had to stand the critical test of a serious business depression; there was no doubt that the system was safe all the time prosperity continued. In this country the intermittency of employment among large classes of the people made it necessary to proceed with great caution. Thus, although the development was one which we must watch with interest and care, there were abundant reasons why we should hasten slowly in the extension of it in our own country. In another part of his speech Mr. Tennant said that the recovery during the past year from the setback of 1926 had been sufficiently quick and sustained to be in itself a testimony to the economic stamina of the country. It had been stated by those best qualified to judge (although means for the accurate measurement of the level of national production were lacking) that the total volume of the country's economic activity to-day was greater than in any year since the post-war slump, and was probably greater than in 1913. Increasing interest was being taken in the shares of what the speaker called the "newer industries," including the electrical and motor-car industries. British electrical exports were higher than those of any other country, and the quality of the products was recognised as unrivalled. Nevertheless, full prosperity could only come with a revival of the basic industries.

Sir Harry Goschen, speaking at the National Provincial Bank meeting, referred to the prosperous state of the electrical industry, and, later, dealing with the general situation, he made mention of the burden which industry had to bear in the form of rates and taxes. He said that income and super-tax did not, or should not, influence the actual cost of production, and it must, therefore, not be overlooked that the incidence of the tax was not of primary importance as affecting the price at which our manufacturers were able to place their goods upon the market. On the other hand, the less the trader's profits were invaded by the tax gatherer, the greater would be his resources for the future development of his business. On that account every step tending towards reduced taxation must be taken. The question of rates was a different story. These had to be paid whether profits were made or not, and were a direct factor in the costs of production. In some places the burden of rates was becoming intolerable, and there was an imperative need for municipal economy. In concluding his speech, Sir Harry said that Continental conditions were now more stable, our trade position last year was more satisfactory, and there was an increasing tendency for capital and labour to work together.

A large part of the speech of Mr. R. McKenna at the Midland Bank meeting was devoted to financial considerations, such as the effects of the restoration of the gold standard and the predominance of the American dollar in international transactions. In his closing remarks, however, he referred to the industrial outlook. He said that there had undoubtedly been a great improvement in the relations between capital and labour, and there had been a steady but substantial recovery of our trade from the grave difficulties of 1926. He did not suggest that we had any cause for unbounded optimism; the problems before us were numerous and complicated, but the background was brighter than a year ago.

Addressing the shareholders of Martins Bank, Mr. R. M. Holland-Martin urged the necessity for the "human touch" in industry. He thought that the tide had undoubtedly turned, and if all internal strife could be ended and all energies directed towards re-establishing this country's great name for the price and quality of its goods, we might hope for a great trade revival. There must undoubtedly be considerable readjustments of men from one industry to another, and even with these readjustments he doubted whether our industries could absorb the growing population. They certainly could not unless costs of production were greatly reduced, which necessitated economies in State and town and home.

Last week Sir P. Cunliffe-Lister, President of the Board of Trade, made a statement regarding the balance of trade. He said that from carefully-compiled Board of Trade estimates it appeared that, taking into account "invisible" exports, the year 1926 showed an adverse balance of £7,000,000. During 1927 our "visible" exports were £392,000,000 short of imports, but against this were placed various items, of which national shipping income and interest from overseas investment were the principal, which gave a total of £488,000,000. Thus, in the past year there was a net credit balance of £96,000,000, which was £42,000,000 in excess of the balance shown in 1925.

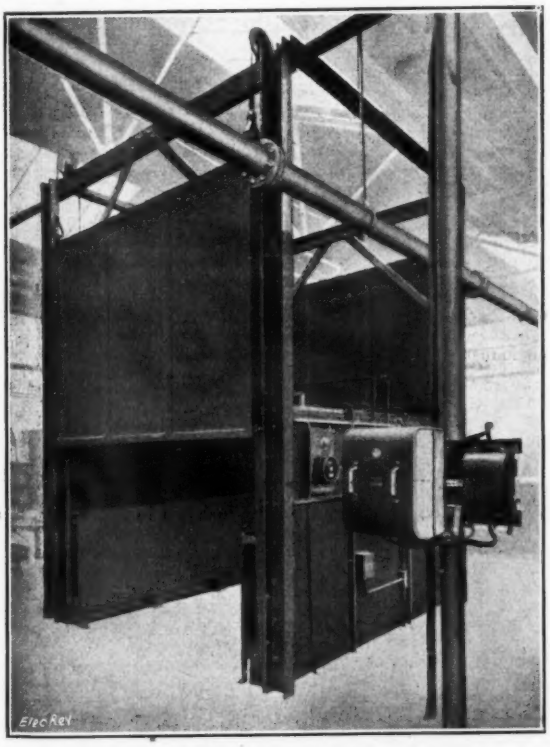
Industrial Electric Heating.

The Fourth E.D.A. Conference of the Session.

AT the conference of the British Electrical Development Association on January 20th Mr. J. H. Crossley, of the Metropolitan Vickers Electrical Co., Ltd., read a paper on "Industrial Electrical Heating: Sales Possibilities." Mr. W. H. Cooke, the Luton borough electrical engineer, was in the chair, and the new director and secretary of the Association (Lt.-Col. W. A. Vignoles, D.S.O.) was also present.

Mr. CROSSLEY said that whilst the industrial heating load was not growing at the rate it should do, there was every sign that this year would see considerable progress. Unfortunately, it was too often said that electric heating was the heat of the future. It was, but why not also of the present? It was true that apparatus had not yet been developed for *every* industrial heating process, but there was not a single industry for which *some* electric heating apparatus was not now available. As regards metal industries, for instance, large furnaces of both British and American manufacture were available capable of melting charges of about 3 cwt. of steel or 5 cwt. of non-ferrous metals, in a much shorter time than was possible with fuel-heated crucibles and under incomparably more pleasant conditions for the worker. Electric furnaces of the nickel-chrome resistor type had been built and erected in this country for the heat treatment of aluminium, brass, steel, and other metals. For heat treating high-speed steel, electric furnaces fitted with silicon-carbide heating elements, and another type in which the whole of the furnace lining acted as a glowing resistor, were available in various sizes. Similarly in the jewellery and ceramic industries, drying and baking processes, bread and confectionery baking, enamel stoving, and for a considerable number of other purposes, electric furnaces were available and in use. One of the most interesting electric furnaces installed in this country in the pottery industry for enamel firing was in the form of a tunnel more than 80 ft. long, through which the ware passed on small bogies; this provided practically a 24-hour load.

As to bread and confectionery baking, Mr. Crossley gave a good deal of information covered in the paper by Mr. Ellerd-Styles before the Institution of Electrical Engineers



A 30-kW Double-ended Industrial Oven.

(*vide* our last issue, p. 171), and added that the first "travelling" electric baking oven to be installed in this country was at present approaching completion for the Manchester Co-operative Society. In most cases of industrial electric heating the cost of power must be low, but the cost of power alone must not be taken as the only criterion when making comparisons with other forms of fuel. Every repair garage in the country should have an electric stove enamelling apparatus, and suitable ovens of any required size could be assembled. Among the miscellaneous applications of industrial electric heating was mentioned the boiling of linseed oil in the Newcastle district, a temperature of 580 deg. F. being required for varying periods, depending on the final quality of the oil desired. This installation comprised an aluminium vessel containing about 100 gallons of linseed oil, mounted in a well-insulated cylindrical container and heated by elements situated underneath the oil container, automatic temperature control being fitted. The power was switched on, and whilst the oil was being heated up the consumption was about 30 kW Thereafter the input was just sufficient to make up radiation losses.

Mr. Crossley contended that heating elements were made which would maintain a heat of 1,000 deg. F. and have a life of from five to ten years, whilst for higher temperatures, such as those required for dealing with nickel-chrome-iron alloys, a life of two years was common. The failure of the automatic control gear was a very rare occurrence, and in any event there were always means for hand control should any failure occur.

Specimens of various elements were exhibited and their strong mechanical construction was demonstrated. These included a typical low-temperature heater suitable for use in ovens or for heating air or oil; a nickel-chromium heating element for use in furnaces operating at temperatures up to 1,000 deg. C.; a silicon-carbide heating element for temperatures up to 1,300-1,350 deg. C.; a "steel-clad" heater suitable for heating press platens, the shoes of large ironing machines, metal platen plates, &c.; and a "Backer" type tubular element. The last is in the form of a long steel or nickel-chromium tube, about ¼ in. diameter, which is electrically dead when the heating wire inside is in use. The heating element is in the form of a spiral of wire running along the centre of the outer tube and insulated from it by a layer of magnesium oxide, and the whole element can be bent to any required shape.

Mr. Crossley said that experience had shown that the cost of maintaining and operating industrial electric heating apparatus was no higher than that of any other apparatus; in fact, the total cost was much less than with other forms. Figures of costs were not easily obtained because those who had put down the first installations were anxious to keep the results to themselves in order that they should reap the benefit. The E.D.A. had appointed an industrial electric heating sub-committee, one of the objects of which was to collect all the possible available information regarding industrial electric heating. Generally speaking, electric heating for industrial purposes divided itself into two categories: (1) that in which electric heat had so many advantages that the cost of the heat alone was negligible; and (2) that in which electricity had to compete on cost alone and therefore was only possible where exceptionally low charges were available.

In showing a number of lantern slides of apparatus, Mr. Crossley mentioned a small electric furnace used for hardening certain steel parts, previously heated in a gas-fired furnace. The particular kind of steel had to be uniformly heated and quenched at a very definite temperature, and the proportion of rejects in the gas furnace was well over 50 per cent. That represented a loss of more than £10 per day for material alone which was eliminated by the electric furnace. A large furnace of the continuous type was now being installed for the heat treatment in large quantities of those particular steel parts. In another instance a London manufacturer contemplated the purchase of a large new furnace. His monthly bill for oil would have been about £45, whereas the cost of electricity would have been about £100 on the ordinary rates. He informed the supply company that he was prepared to pay up to £75 per annum, and fortunately the company met him and the installation was put in. Such cases emphasised the need for careful discussion between the manufacturers of the apparatus, the supply authority and the user when any problem of this nature arose. Among the apparatus mentioned was the 30-kW double-ended industrial type oven, with automatic control gear, shown in the accompanying illustration.

Mr. Crossley strongly recommended supply authorities to appoint a special representative to handle industrial heating problems, and mentioned the fact that courses were arranged in America whereby such representatives were trained on lines which enabled them to handle the business in an expert manner. Such courses were only successful if the manufacturers and the supply authorities co-operated. The Newcastle and Yorkshire Power companies had appointed such representatives. Salesmen should arrange to spend a certain amount of time, periodically, at the works of the manufacturers of apparatus and make notes on elementary points of design which would be of value to them in preparing estimates for

various types of installations. He suggested that the type of course for the instruction of such salesmen should be considered by the E.D.A. in conjunction with the supply authorities. Mr. Crossley finally made the suggestion that it would be a good plan to concentrate on particular industries, one at a time, in the matter of industrial electric heating, as by that means there would be far better chances of rapid development.

Discussion.

The CHAIRMAN said the one thing arising from the lecture was that the user of electrical heating apparatus would have to be educated to understand really what could be done. At the same time it was important to be able to obtain power at a very low figure.

Mr. W. E. ROGERS (West Ham) said that under the national scheme of electricity supply a good many station men would lose their employment, and he suggested that they should be appointed as industrial heating experts. If men without engineering experience were appointed for this work at a low salary the results would be hopeless.

Mr. A. E. ILIFFE (Benjamin Electric Co., Ltd.) urged the importance of making comparisons on the basis of total costs and not fuel costs, and of giving prominence to the many other advantages which electricity offered.

Mr. C. HAYES said that the expansion which must take place in the use of electricity under the national scheme would call for a very large number of engineers to take up development work.

Lt.-Col. W. A. VIGNOLES said that the E.D.A. was tackling the problem of industrial electric heating on the basis that it was first necessary to convince the industry itself of the possibilities. The sub-committee which had been appointed would, among other things, endeavour to obtain full descriptions of all the industrial electric heating installations in the country, and that information would be circulated as soon as it was available. He was inclined to think that electricity in this country was a good deal cheaper than many people imagined. A number of undertakings were selling it at ½d. per kWh for power purposes, and before long there would be a good many more. In any case the price of energy was very often by no means the determining factor. He welcomed the suggestion that individual industries should be concentrated upon, and as a start hoped to get out a leaflet very shortly dealing with the suggestion made by the lecturer that every repair garage should have a small electrically-heated enamelling oven.

Mr. CROSSLEY mentioned that a great deal had been done in the pottery district by Mr Yeaman in reducing the cost of energy, with the result that two large kilns with a 24-hour, seven-day load had been installed, and it was more than possible that within a few years there would be a dozen or more such kilns in use.

Mr. TAYLOR recommended the adoption of the policy followed by the Yorkshire Electric Power Co., when it opened its new power station, namely, of inviting manufacturers of various apparatus to exhibit and demonstrate. He mentioned a plant in the South of London where the cost of producing the particular product had been reduced from 11s. per cwt. when using gas, to 3s. per cwt. with electricity, without any special cutting of the price. Moreover, the customer was duplicating his plant.

Mr. DANE (Leyton) suggested the sale of industrial heating apparatus on hire-purchase terms.

References were made by one or two speakers to the possibility of using electrically-heated panels for kinemas and similar places, and Mr. Crossley referred to an article in the ELECTRICAL REVIEW in 1927 describing the electrical heating of a kinema. He said that the manufacturers would welcome the hire-purchase of industrial electric heating apparatus.

The E.D.A. Exhibition at Bromley-by-Bow.

BY the courtesy of the Metropolitan Borough of Poplar Electricity Committee, an exhibition and demonstration of industrial electric heating apparatus, organised by the Industrial Heating Committee of the British Electrical Development Association, was opened at the new electricity works at Glaucus Street, Bromley-by-Bow, on Monday last, and will remain open till February 4th. Eleven firms are taking part in the show, and some of the exhibits are worthy of special notice.

A feature of the display of the WESTMINSTER ENGINEERING CO., LTD., is a 15-kVA non-automatic spot welder, fig. 1. This machine has a reach of 18 in., and both top and bottom electrodes are adjustable for angle and elevation. The electrodes are water-cooled and fitted with detachable copper tips, which can be easily and cheaply replaced. The transformer is suitable for working on single-phase, 415-V, 50-cycle circuits, and is contained in the iron case of the machine. The primary winding has tappings connected to a 6-stop regulating switch so as to give various welding speeds. The current in the top arm is carried by a heavy-copper flexible connection, and not through the pivot. The machine is controlled by a pedal which, through an adjustable spring, applies the necessary pressure to the weld, and, by increased pressure, cuts off the current and applies the necessary upset pressure to ensure a sound weld. The machine is capable of welding ⅜-in. mild-steel plates, each spot weld taking approximately three seconds. With thinner material the weld is practically instantaneous.

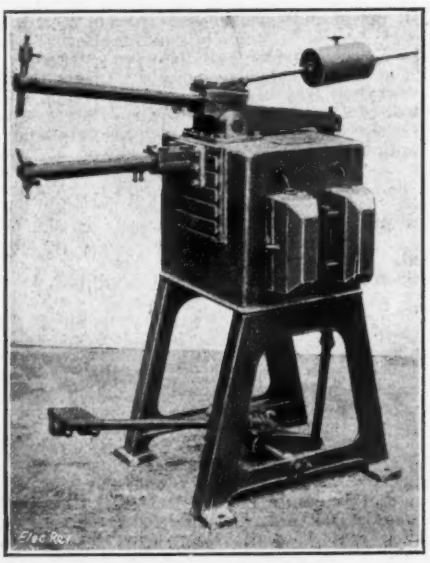


Fig. 1.—A Non-Automatic Spot Welder.

Another machine shown by this firm is a 5-kVA semi-automatic wire welder. This is suitable for 250-V, 50-cycle circuits. It is primarily designed for producing butt welds in copper wire where friction of the moving contacts is very detrimental. To obviate this as far as possible the moving arm is carried on pivots and the current is transmitted through a very flexible connection. In order to keep down the inertia of the arm an aluminium casting is used. The heads for carrying the wire clamps are adjustable for height and alignment, and the machine will deal with copper wire of from 0.030 in. to 0.192 in. in diameter. A press-button switch closes the primary circuit of the transformer and the junction between the two wires to be welded becomes plastic. Under the action of a control spring the moving jaw moves slightly forward, and this motion is transmitted through a rod to an automatic trip switch, so cutting off the current. The same machine is used for butt welding mild-steel wire of up to 5/16-in. diameter.

The HOTPOINT ELECTRIC APPLIANCE CO., LTD., is showing an electric portable air blower for the forge or blow pipe, which comprises two special blowing motors encased in a sheet-steel box to which is fitted outlets for attaching two flexible tubes. Provision is made for connection to an ordinary lampholder, and both machines can be used at one time; the maximum consumption of each motor is 160 watts.

A "Hotpoint" electric soldering iron with a hatchet-shaped bit, which is designed for use where soldering jobs are done periodically on heavy work, is also included in this company's display. The copper bit and its shank, on which the heating element is wound, is easily removable. On this stand may also be seen a number of cast-in immersion units for metal-melting pots. These are made of "Hotpoint" sheathed wire cast into iron, providing a unit that is strong electrically and mechanically. They are designed for melting lead, tin, solder, and similar alloys and metals, and range in size from a small one with a loading of 750 watts to one having a loading of 5 kW. "Hotpoint" electric glue-pots are also being shown. These are made in sizes having capacities of 1-1½ and 2-2½ pints, with respective loadings of 500 and 600 W.

On the stand of the LEEDS ELECTRICAL CONSTRUCTION CO., LTD., are shown a couple of "Lecfur" electric furnaces. One of these, type B.H.T. 10, is suitable for operation at up to 1,350 deg. C. for the heat-treatment of high-speed steel. The other furnace, B.E.4, is designed for operation at temperatures up to 1,050 deg. C., and is suitable for such duties as carburisation, the heat treatment of various parts and fusing enamels. This exhibit also includes an electric metal-melting pot which has a capacity for 25 lb. of lead and will melt 75 lb. in one hour for 1 kVA loading.

A feature of the exhibit of Messrs. MARRYAT & PLACE is their R.T. 25-3 type of electric rivet heater (fig. 2). This is a 3-head machine having a loading of 22 kW. It is air cooled and the gross weight is 1,650 lb. The packing-case dimensions are 5 ft. by 5 ft. by 4 ft. 9 in. The machine is capable of dealing with rivets of sizes varying from ⅜ in. × 2¼ in. to 1 in. × 3¼ in., the respective outputs varying from 300 to 150. The current consumption claimed for machines of this type is 1 kWh per 5¼-10 lb. of rivets, according to their size. The larger the rivet the greater is the weight heated per unit. Water cooling is adopted for larger machines, of up to 45-kW loading. Four degrees of heat are provided. The machines are mounted on wheels and steel rings are provided at the top corners for slinging.

Fig. 2.—An Electric Rivet Heater.

A Wild-Barfield automatic hardening furnace is being shown in operation by Messrs. AUTOMATIC & ELECTRIC FURNACES, LTD., and in connection with this exhibit Messrs. Lehmann, Archer and Co., Ltd., toolmakers, have diverted some of their tools from their Wild-Barfield furnaces to the Exhibition, where visitors can see the actual method of operation for production hardening. Messrs. Lehmann, Archer are supplying a hardener from their own works, and fig. 3 shows the type of furnace in which the tools are being treated. A Wild-Barfield high-speed steel-hardening furnace, embodying the usual preheating and final hardening chambers, is in operation on this stand at 1,400 deg. C.

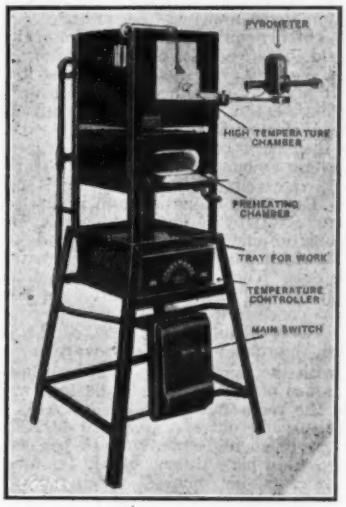


Fig. 3.—A W. B. Hardening Furnace.

A low-temperature tempering oven, and an internally heated, carburising furnace are also displayed on this stand. These were also exhibited at the Shipping and Engineering Exhibition last year (ELECTRICAL REVIEW, September 30th, p. 559).

(To be continued.)

Radiant Heating.

A general survey of the heating problem, and a description of some of the more modern methods of radiant heating.

By A. H. BARKER, B.Sc.

(Report of a Paper read before the ROYAL SOCIETY OF ARTS.)

A GOOD deal of the early part of the paper was devoted to an examination of the general principles applying to the problem, and the author expressed surprise that so little consideration had been given in the past to the physical means by which the distribution of heat was effected from the heating medium to the interior of a room, and to the effects produced by the different means. It was equally surprising, he said, that the method adopted up to within very recent times had been very largely the convective method of distributing heat. We were here up against the very heart of an extremely difficult and elusive problem.

Whilst general experience showed that when the thermometer reading in an ordinary building was between, say, 58 and 70 deg. F., the building was commonly regarded as comfortable, and the thermometer temperature, therefore, had come to be regarded as a measure or criterion of heat comfort; this was a very narrow view to take. The thermometer reading had a limited application when applied to the special case of an ordinary building which had been kept warm by convection for a long period, but it was misleading as a general principle because it did not take account of all facts, experience, and observations. One statement that could certainly be made was that whatever other instrumental means might ultimately be found to represent comfort correctly, certainly a plain thermometer did not, except only that when the method of heating and the thermal distribution were similar the height of the thermometer did give a sort of measure of the feeling of warmth. It was important to understand that in radiant heating the thermometer was no guide to comfort.

The solution of this vital problem lay at the root of successful heating engineering. If the object of heating engineers was, as was obvious, to make a room comfortable in respect of heat, and if they could not with precision and certainty lay down what physical conditions did constitute comfort in a room, it would be seen that the whole scientific basis of heating engineering was in doubt. A cold room could be made comfortable to inhabit by introducing in some way an adequate quantity of radiant energy, and it was a matter of experience that if the heat were introduced in an appropriate manner the amount of heat required was distinctly less than if it were introduced in the form of convection currents.

Generally, radiant methods of heating could be divided into two classes, the high-temperature, or incandescent, methods, and the low-temperature, or distribution, methods. The former consisted in maintaining some radiating body at a high temperature at which each point of the hot surface gave off a beam of rays. Such a beam was of a number of different wave-lengths extending far down into the infra-red, and in such a beam infra-red rays carried the most energy, though the luminous rays, from the green downwards, were of importance. In the low-temperature methods the radiation was produced from a larger area of surface maintained at a much lower temperature. These surfaces were exposed to the interior of the room, and gave off beams of rays, all of which were in the infra-red region; *i.e.*, the beam was entirely non-luminous and invisible.

It had been found by experience that radiant heat of this second character could be utilised to make a room comfortable at a much smaller expense of energy than when the radiation was of a luminous character. The reason probably was that glass was much less diathermanous to rays of longer wave-length, and much more so to waves of shorter length. Thus, a large part of the heat introduced as luminous waves passed through the glass of windows and was lost. Also, wall surfaces would absorb a much larger proportion of the luminous heat impinging on the walls of a room; such heat was absorbed by the surfaces and was rapidly conducted to the outside and

lost in the outer air, whereas a much greater proportion of the dark heat would be reflected back into the room. Such was the difference in effect. He did not think it possible for anyone to distinguish incandescent heat from the dark variety by sensation. The sensation effect of a given intensity of radiation on the skin was probably the same in all cases irrespective of wave-lengths, although of this he was not absolutely sure. It appeared probable, however, that the physiological effects of light and dark heat must be different. It was probably that the bright heat was more physiologically advantageous than the dark heat.

The author then discussed the incandescent method, requiring some highly concentrated supply of energy in the form either of solid fuel or of gas, oil, or electricity. The ordinary electric fire, he said, did not usually distribute more than from 40 to 70 per cent. of its heat, according to the type, in the form of radiation, the remainder being convected. Discussing the type of electrical fire arranged to present an appearance similar to that of a coal fire, with reflectors arranged to radiate a certain amount of heat from the front, he said that though they were very desirable in certain positions in well-to-do homes, they were expensive both in first cost and energy consumption, especially if any considerable amount of heat were required. Functionally, they provided a mild beam of radiation of which a relatively large proportion consisted of light-giving rays. They were often so placed that a considerable portion of their heat was wasted so far as the room warming was concerned. They should never be placed under a chimney. Only about 30 per cent. of the heat given off was radiated, the remainder being convected.

Dealing with the appliances giving dark heat, Mr. Barker said the essence of this method of heating was to maintain exposed to the room interior a large surface at a medium temperature, usually not exceeding 120 deg. F., but in some examples very much higher. About 60 per cent. of the heat given off by such a plate was usually in the form of radiation, and in some cases, he believed, much more, depending on the movement of the air in contact with the plate.

There were many disadvantages in maintaining a high temperature, both because of the danger and the unpleasant character of the heated air it gave off, due to the charring of ammoniacal dust particles, and also on the score of economy. Any given amount of heat spread over a large surface at a low temperature was much more effective in producing a feeling of comfort in a room than if the same amount of heat were spread over a smaller surface at a higher temperature. Thus there was a conflict between first cost and economy of upkeep. The higher the first cost the smaller the cost of upkeep for the same heating effect.

The principal advantages of this radiant method were that it dispensed with the feeling of stuffiness which always existed to a greater or less extent when the means of transmission were purely convection, and which formed the principal obstacle to the general adoption of central heating. The second and outstanding advantage was that a large reduction in the cost of heat was effected by it. He believed that the convection type of heating would be carried out in future only in places where it was necessary to distribute the heat in complicated chambers.

One of the drawbacks of the low-temperature radiant method was that the effect of the hot surface was diminished in situations where an unobstructed view of the heating surfaces was not obtainable. If the hot surface were out of sight its effect was a good deal reduced. This implied that more heating units were necessary than would be required with convective structures, which tended to increase the first cost. If the heating surface could be placed on the ceiling it could hardly be obstructed by furniture. It was likely, therefore, that in future much of the heating would be done by surfaces of this character fixed on the ceilings, though this position had also its disadvantages, especially the danger of damaging tables and other furniture placed immediately below, and the floors immediately above.

The author then discussed the various methods evolved for the application of this form of heating, particularly the use of metal panels on the walls and ceilings, which, in addition to being heated by means of hot-water pipes, lent themselves to use with gas or electricity as the heating medium, and would probably become very general. In cases where economy was of greater importance than artistic appearance, he said, the panels might be bolted directly on the wall or ceiling and left exposed without any kind of concealment. Where complete concealment was of importance the panel was let into a recess formed in the wall or ceiling. The panel was provided in the form of a perfectly flat plate, the face of which was fixed flush with the wall or ceiling surface, or, if not absolutely flush, it might project slightly in the form of a panel which might be arranged as part of the decorations. It might then be covered with a thin veneer of metal, if desired. The edges might be confined by a beading or frame, or otherwise. In other cases the panels were formed as a complete or partial dado round the walls. The plates were cast from patterns made like an ordinary oak dado, in which oak graining had been incorporated, so that when suitably coloured they had the exact appearance of genuine oak; indeed, it was impossible to distinguish them in appearance from ordinary panelling made of oak or other wood. The master patterns were actually first made in genuine oak. They were then treated with a sand blast, which had the effect of cutting out the soft parts of the wood between the hard veins, thus emphasising the graining. Iron patterns were then cast from this wood pattern, from which the final castings could be cast in large numbers, each bearing the exact appearance of the oak graining of the original wood pattern, and this was very much cheaper than real oak panelling.

When heating was to be effected by means of electricity, the passages in the panel could be supplied with electric coils through which a current of electricity from the power mains would generate the necessary heat, which was distributed by the plate all over the surface. The effectiveness of this form of heating made possible heating by gas or electricity in many cases where the expense of convective heating would be too great. In this way a room could be heated electrically at about half the cost of heating by ordinary electric radiators. Other methods of warming panels by means of electrical energy had also been introduced.

Another type of heating dealt with was that produced by textile means, in which a continuous wire was interwoven with the cloth, the wires being the warp and the wool or silk the weft. Electric current passed through such a material, when in good order, caused the cloth to be uniformly hot all over. It was commonly used for pictures, seats of chairs and the like, or screens. It had the advantage of lightness and portability, and the disadvantage that a possible fracture of the electrical conductor might occur, in which case, naturally, the current would be cut off. There would also be the danger of a user receiving an electric shock if anything went wrong with the terminals or connections.

Radiating surfaces of several unique kinds were being made. One of the most notable methods was the heating of large glass mirrors by the insertion of electrical resistance circuits behind them which warmed up the glass and produced the same effect. Similarly, metal plates had been treated by fixing to the back of them coils of suitable resistances, whereby the plate was warmed uniformly all over.

Dealing with methods involving the heating of floors, he said this form of heating was not strictly radiant heating, but a combination of all three agencies—conduction, convection, and radiation. It overcame the difficulty experienced in some large buildings and halls where, although the space as a whole was well warmed by convection methods, the floor was apt to be very cold. The principle of heating through the floor had been adopted in Liverpool Cathedral, among other buildings.

Discussion.

Mr. LLEWELLYN B. ATKINSON (Past President, Institution of Electrical Engineers) said that there had been a great change of opinion with regard to heating. Gradually we were coming more and more to sitting in rooms which were cool so far as the temperature of the air was concerned, and warming our bodies by radiant heat. He was not sure that, on close analysis, part of the difference between sitting in a room containing cool air and a source of radiant heat, and sitting in a room where everything was practically of the same temperature, did not very largely turn on the question of humidity. Most people had the idea that in winter the air was very wet and in the summer it was very dry, but that was not correct. The humidity of the air did not vary a great deal all the year round, as a rule. In the winter, when the temperature was low, the number of grains of moisture per cubic foot of air was low as compared with the number of grains per cubic foot in the summer, and in the house, where the temperature was raised to practically the same temperature all the year round, the fact that the air was drier in winter caused greater evaporation from the body. Some of the effects experienced were really due to the fact that we were evaporating too much moisture by having raised the temperature of the air and having so made the relative humidity very much lower. Referring to Dr. Ferranti's all-electric house, near Buxton, he said that a good deal of cooling water was used for the oil engine there, which water, when heated, was carried through plates in the ceilings, so that the house was heated by means of the waste low-temperature heat which could not otherwise be used. Electric radiators were also provided for those who wanted a little immediate radiation, and electricity was used for lighting, cooking, and to provide motive power for household purposes. Nearly the whole of the heat generated by the burning of the oil in the winter months went into the house.

Dr. MARGARET FISHENDEN (Fuel Research Board), referring to Mr. Barker's suggestion that panel heating was more economical than the incandescent form of heating because the short wave-lengths passed through windows more easily than did the long wave-lengths, and because short wave-lengths, or luminous radiation, was absorbed more readily by wall surfaces than was the dark radiation, said she found it difficult to believe that either was the reason. The explanation was more likely to be found in the better distribution of heat by the panel system.

Mr. C. INGHAM HADEN (Past President, Institution of Heating and Ventilating Engineers) said that the floor of Liverpool Cathedral might be called the largest radiator in existence at the present time in this country. As to the efficiency of the system, he said it had been found that from the floor level to a height of 117 ft. the temperature varied very slightly. A separate system had been provided for the purpose of heating the upper air. He had felt sure, in the first place, however, that it would be possible to obtain the desired results without

the latter system. Measurements had shown that from a height of 5 ft. to a height of 90 or 95 ft., the drop in temperature, without the upper heating system, was 1½ deg., and when the upper system was installed there was not a difference of 1 deg. That proved that the air in the Cathedral was intermixing all the time, so keeping the temperature practically uniform.

Prof. F. L. HOPWOOD asked what was the best way of heating a bedroom or a sick room.

Mr. GEORGE NOBBS said that the system of building-up low-temperature heat by means of panels was quite good, and he pointed out that electric heating could be applied to those panels in a most effective way.

Dr. ELWIN H. T. NASH referred to researches which had been carried out with regard to the application of ceiling panel heating, particularly in schools, which bore out Mr. Barker's remarks. In two schools where ceiling panel heating had been adopted the difference in temperature as between any two parts of the same room was not more than 1.5 deg., and the results showed an immense improvement over convective heating. In one of the schools the teachers had said that when the temperature was 55 or 57 deg. they were much more comfortable than when convective heating was applied, with a temperature of 60 deg. There was no question that ceiling heating, so far as schools were concerned, had come to stay. Ceiling panels had a great advantage over wall panels, because it seemed that wherever a wall panel was inserted the persons sitting near to it were getting rather more heat than they required. One drawback with ceiling panel heating was that there were down-draught currents from the windows, but that difficulty could be overcome and a uniform temperature obtained by placing a small convector or some form of radiator under each window. With regard to the question of economy, he said his figures had shown that the prime cost of installing a ceiling panel heating system was 35 per cent. more than that of installing the ordinary convective heating system, but the running expenses were 55 per cent. less.

Mr. D. BETTS suggested that the reason why panel heating was more economical than other forms of heating was that it cut out convection, especially in the case of ceiling panels. The fact that there was a very great economy to be obtained by the use of panels was well demonstrated by the Liver and the Cunard Buildings at Liverpool. The Liver building, which was 50 per cent. larger than the Cunard building, was heated by panels, most of them in the walls, but some of them in the ceilings; the fuel bills for the two buildings were practically the same year by year.

Major P. H. RICHARDSON suggested that there was a tendency to think too much about heating and to forget ventilation.

Mr. BARKER, replying to the discussion, said that he preferred, in the interests of health, not to heat bedrooms, but if he wanted to heat a bedroom in an ideal way he would certainly adopt some method of radiant heating. He agreed that one of the reasons for the superior economy of radiant heating over other forms was that the heat was better distributed, and also that radiant heating, if suitably applied, very largely cut out convection, especially where the panels were fixed in the ceiling.

The Chairman (Prof. A. E. RICHARDSON, F.R.I.B.A.) said that some system of incorporating the heating service in the construction of a building was the thing of the future, and architects would have to encourage it to the best of their ability.

Industrial Fatigue Report.

In a joint report of the Industrial Fatigue Research Board and the Illumination Research Committee, by H. C. Weston, M.J.Inst.E., and A. K. Taylor, M.I.E.E., some experiments are described on "The effect of different systems of lighting on output and accuracy in fine work (typesetting by hand)."—H.M. Stationery Office, price 4d. net. The data presented in the report afford sufficient evidence to justify the conclusion that a considerable amount of general illumination in composing rooms is necessary to secure the best results. General lighting alone, whether direct or semi-indirect, appears to be satisfactory if the degree of illumination is adequate, while semi-indirect lighting has the advantage of reducing the glare experienced with new type. Incidentally the problem of glare from new type might be capable of solution by means other than modification of the lighting equipment, and it is suggested that some method for partially ageing the type before it is put into use should be tried. In some composing rooms general lighting may be unsuitable on account of structural features, which will prevent the elimination of undesirable shadows, and in such cases a combination of general and local lighting, in which the two types of source will give approximately the same proportion of the total illumination, is to be recommended. Totally indirect lighting involves a loss of output, but it has the advantage of reducing reflected glare from the type. There is some evidence that the colour of the light used in composing rooms may be of some importance in relation to the question of glare, but, without further experiment, no definite statement on this point can be made. The results show that purely local lighting is definitely inferior to other methods from the point of view of production, more especially if the fittings employed do not properly screen the lamps so as to eliminate direct glare.

Electric Lamp Data.

By F. J. HAWKINS.

(*Abstract of a Paper read before the* RUGBY ENGINEERING SOCIETY.)

FOR lamp-designing purposes it is very desirable to have accurate and reliable data available, to enable special lamps to be made without undue delay which may be caused through the necessity of running experimental and trial lots. The superiority of one filament material over another is almost entirely dependent upon its physical characteristics and properties; for example, the property tungsten has of remaining stable at very high temperatures, and the fact that it emits a larger percentage of its radiation in the visible part of the spectrum than most other metals, are conditions which greatly favour the use of the metal for lamp filaments. In the case of carbon a slight decrease in its resistance occurs at very low temperatures, but it afterwards becomes constant with increased voltage up to 130 per cent. of the normal. A filament with a negative temperature coefficient is undesirable, inasmuch as the current increases at a rapid rate with increased voltage, and for this reason metals are the more suitable materials for lamp filaments. The change in resistance varies considerably with different metals, tungsten having the highest ratio of hot to cold resistance. Tungsten-filament lamps will therefore be less affected by an overrun in voltage. The following table indicates the comparative efficiencies of the various types of lamps for equal life :—

Type.	Comparative Efficiency, W/m.s.c.p.	Ratio: Hot Resistance / Cold Resistance
Carbon	5.0	0.95
Gem	4.0	2.0
Tantalum	2.1	5.1
Osmium	2.0	8.3
Tungsten (vac) ...	1.4–1.7	12.3
Tungsten (small gas)	1.1–1.5	—
Tungsten (large gas)	0.6–1.0	—

The specific resistance of carbon at atmospheric temperature is about 800 times that of tungsten, but at normal working temperatures it is only 33 times as great. The low specific resistance of tungsten is an advantage where lamps of very low voltage are constructed, as a reasonable length of filament is required to be mounted; but for h.v. lamps it is a disadvantage, owing to the necessity of mounting long thin filaments, causing complications in the construction.

The efficiency of a lamp measured in terms of watts per c.p. is indirectly a measure of the operating temperature of the filament, consequently, provided lamps of similar formation or construction are compared, their relative efficiency directly indicates the variation in life which might be expected. The higher the operating temperature of a filament, the greater is the rate of its evaporation; it therefore follows that as the consumption in watts per candle is reduced, or, as the light output becomes more efficient, the life of the lamp is shortened.

It is now possible to estimate with reasonable accuracy what the life of a certain type of lamp will be at any particular rating in watts per candle. Experience dictates that the lives of vacuum lamps vary approximately as the 7th to 8th power of the watts per candle, whilst those of gasfilled lamps vary as the 6th to 7th power of the watts per candle.

Langmuir has given the following relations which, at a definite temperature, connect the size of the filament with the watts, candle power, resistance, and so on :—

Watts	vary as	$l\,d$
C.P.	,,	$l\,d$
Volts	,,	$l/\sqrt{d}$
Amperes	,,	$d^{\frac{3}{2}}$
Resistance	,,	l/d^2

Where l=length of wire and d=diameter of wire.

The most important point about these relations is that if the temperature of operation of the filament is specified, then fixing the watts and volts determines both the length and diameter of the filament.

Australia and British Goods.

The Manchester Chamber of Commerce recently made a statement that even the preferential rate of duty imposed upon British goods on importation into Australia was too high to enable trade to be done freely. In reply to this the High Commissioner for Australia has issued a statement showing that, on the contrary, Australia has taken an increasing proportion of British exports. In 1913, he says, Australia absorbed 6.5 per cent. of these exports; this proportion had risen to 8.2 per cent. in 1926, and in the first nine months of 1927 was 9.4 per cent. In a list of important classes of goods, electrical machinery appears, and it is shown that whereas in 1913 Australia took 12.6 per cent. of the British exports, in 1926 she took 17.5 per cent., and in the first nine months of 1927, 18.7 per cent.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

New Lighting Fittings.

What appears to be a departure from the usual method of light distribution from electric light fittings is that introduced in this country by Mr. ROGER BURGES, Windsor House, Victoria Street, S.W.1, by means of a range of "Treph" lamp fittings. The "Treph" fitting, fig. 1, has three shades arranged concentrically one above the other. The lamp is placed in the centre of the combination, and the light is reflected from the undersides of the shades. It is claimed that there is no dazzling effect, due to the filament brightness being distributed over the very much larger area of the reflecting surfaces, and that there are large gains in efficiency and current consumption. The illustration shows a hanging-type "Treph" fitting of the low-suspension pattern.

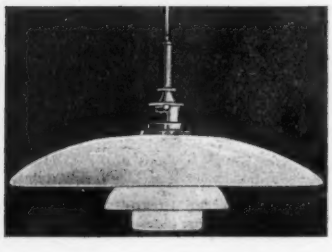


Fig. 1.—A "Treph" Fitting.

Fig. 2.—The "Ionic" Hand Lamp.

A New Electric Hand Lamp.

The accompanying illustration, fig. 2, depicts a recent introduction of Messrs. IRON & NICKEL BATTERY CO., LTD., 17-19, Cockspur Street, Pall Mall, S.W.1, the "Ionic" electric hand lamp. Both the lamp case and the battery are constructed of iron and nickel, the battery being an "Ionic" all-steel alkaline accumulator. It is claimed that the battery has practically no self-discharge and that it is unspillable and will give 20 hours' continuous lighting per charge. The switch is conveniently placed in the handle for operating by the hand carrying the lamp.

A Unity-Power-Factor Motor.

The "Tru-Wat" motor, fig. 3, which has recently been developed by Messrs. CROMPTON PARKINSON, LTD., Guiseley, near Leeds, is claimed to possess the advantage of running at nearly unity power factor without the disadvantages of the auto-synchronous motor with a separate exciter. The exciter of the new machine is built into the motor, forming a self-contained unit. It is claimed that the advantages of powerful starting torque and simple control gear are also retained, and that truly automatic synchronising is obtained against heavy overload merely by the operation of the normal starting resistance handle. Standard stator and rotor starters are employed for the "Tru-Wat" motor, embodying the makers' two-phase secondary connection, and as far as the operative is concerned the starting operation is identical with that of the ordinary machine. The new motor is standardised in various sizes from 15 b.h.p. to 125 b.h.p. at 750 r.p.m., and also for speeds of from 500 to 1,500 r.p.m. to suit various classes of industrial machines.

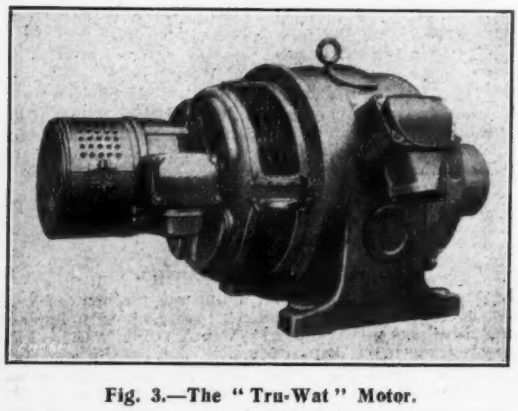


Fig. 3.—The "Tru-Wat" Motor.

New Electric Fires.

The "Boomerang" electric fire, fig. 4, is a recent introduction of Messrs. ELECTRIC HEATING & HARDWARE, LTD., Crown Works, Berkley Street, Birmingham. Plug-in elements are employed which are interchangeable with the makers' "Glowincoal" models. The reflector is of pure figured copper. It is claimed for the appliance that sufficient heat for normal requirements is directed to the feet, without doing harm to carpets or polished floors, and a low line of intense heat is projected across the room. The radiator is supplied with a copper-bronze finish, and the loading is 3,000 W.

Fig. 4.—The "Boomerang" Fire.

Another recently introduced electric fire is that shown in fig. 5, the "Corporation," a production of the COVENTRY ELECTRICAL APPLIANCES, LTD., Conduit Yard, Fleet Street, Coventry. It is built in a polished casting finished in either black, brown or blue enamel. It is of the one-bar element type, and the standard loading is 500 W, but a 1,000-W spiral can be fitted, provided the supply pressure is suitable for the increased loading.

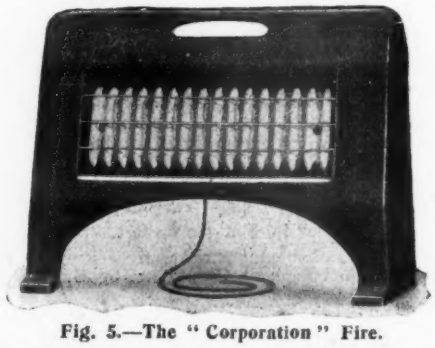


Fig. 5.—The "Corporation" Fire.

A New Rotary-Reciprocating Switch.

We learn that, in response to a request from an important public electricity supply company, the HART MANUFACTURING CO., of 76 and 76B, Rochester Row, S.W.1, has designed a new type of rotary-reciprocating three-heat series-parallel "Diamond H" switch, wherein, it is claimed, it is impossible to switch from the "high" or parallel" position to "off," or from the "off" position direct to "high." The same reciprocating action is used in this switch as in the previous models, and the usual selectivity can be obtained in all the other positions.

A Tumbler Switch.

We have received from Messrs. ENTERPRISE MANUFACTURING CO., LTD., Electric House, Grape Street, Shaftesbury Avenue, W.C.2, a sample switch which they are just marketing. It is a 5-A model of the usual domestic type, with a steel-bronze dolly, bracket and cover, and is available as one- or two-way. The construction is substantial and a feature is the simple throw-over mechanism.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

(Concluded from page 169).

Crompton, Parkinson, Ltd.

Amongst this company's instruments a portable a.c. multi-range amp.-voltmeter with a single movement was noticed; it is a development of last year's "iron-ring" ammeter. It is so adjusted that a single conductor passed through the ring, carrying 100 amperes, gives full-scale deflection, and is, therefore, operated by 100 ampere-turns and full scale deflection will always be obtained, however it is made up; for example, by two turns carrying 50 amps., five turns carrying 20 amps., or by 100 turns carrying 1 amp. As in some cases it may not be possible to pass the conductor through the ring, the part projecting from the oak carrying case is made detachable so that a conductor may be encircled without breaking connection, or a coil with a large number of turns can be placed round the iron magnet ring. The instrument can be used as a multi-range voltmeter: "units" for low ampere ranges and for volt ranges can easily be fitted on the pack, and series resistance "units" are arranged to screw into the side of the main volt unit. B.S. first-grade accuracy is obtainable.

Elliott Bros. (London), Ltd.

This company's display included a nickel-iron-core "Multiversal" current transformer of precision accuracy in one piece, though it has five self-contained primary ranges, and by means of a cable wound through the central hole provided an additional ten ranges may be obtained, giving in all fifteen current ranges on the one transformer; it will stand a test of 13,200 volts between primary and secondary and primary and iron for one minute; the secondary is wound for a full-load current of 5 amperes, and provided with a self-contained short-circuiting switch to protect the transformer should it be desired to disconnect the secondary burden. A portable moving-coil galvanometer, type "C.S.," with double-taut-strip suspension, has been designed to afford sensitivity obtainable hitherto only in the elaborate reflecting laboratory form. It is extremely robust, and does not require accurate levelling; no special precautions are necessary for safety in transit, and no travelling clamp is required to prevent damage; it is provided with a knife-edge pointer and anti-parallax mirror, and also a mirror for laboratory work.

Nalder Bros. & Thompson, Ltd.

The inherent accuracy of "First Grade" induction instruments, fig. 13, is said to be higher than the B.E.S.A. first grade; the temperature coefficient is less than 0.02 per cent. per deg. C., and the frequency error below 0.2 per cent. for a rise or fall of 10 per cent. The momentary overload capacity is

Fig. 13.—"First Grade" Induction Ammeter.

5,000 per cent. For saving switchboard space a range of combined p.f. meter and ammeter, wattmeter and ammeter, ammeter and voltmeter, three ammeters, &c., has been developed, housed in a rectangular case measuring 5¼ by 10¼ by 5 in. The new reverse-current a.c. relay, which was exhibited for the first time, was described in our issue of December 16th, 1927.

Gambrell Bros., Ltd.

These exhibits included an instrument for the measurement of the alteration of diameter of a cable while under load; it is easily calibrated, extremely small variations can be read, while the rate of recovery and any permanent set can be readily determined. A bridge has been designed for the measurement of the inductive capacity and power factor of high-grade oil, which makes it possible to apply pressures up to 3,000 volts r.m.s. with safety. Another bridge shown was for indicating directly the p.f. and capacity of cables at high voltages.

Kelvin, Bottomley & Baird, Ltd.

The selection of ultra-violet light apparatus on view included a fluorescence cabinet, water steriliser, ophthalmic lamp, actinometer, and quartz electrodes for producing u.v. light by high frequency. A lamp was also shown for shadowless illumination; reflecting surfaces are employed, not lenses.

Radio-Telephone Exhibits.

The Dubilier Condenser Co. (1925), Ltd., amongst a large selection of components, showed a.c. and d.c. patterns of anti-interference condenser devices for use in conjunction with small domestic motors when the latter are operated in close proximity to broadcast radio receivers. The "K.C." air condenser has its rotary vanes connected to the metal end-plates, which are normally connected to the low-potential point of the tuning circuit; the fixed vanes are held insulated between bakelite pillars in compression, which arrangement reduces dielectric losses. A slow-motion drive gives a reduction ratio of the order of 200:1, and the condenser is specially designed for uniform kilocycle (or "s.l.f.") tuning, in combination with "Toroid" high-frequency transformers, which eliminate the necessity for providing metallic shields between the stages of a radio-frequency amplifier and, owing to the absence of stray magnetic fields, neutralisation of the intervalve reaction becomes simple, a special connection being recommended for this purpose.

An item of merit in the display of the Igranic Electric Co., Ltd., was the "Lokvane" square-law variable condenser, which derives its name from the ingenious method of mounting the vanes so as to lock them in position rigidly and to provide adequate electrical connection between them. The "Indigraph" vernier knob and dial has been modified in design, and was exhibited, together with a novel type of dial illuminator, for attachment at the back of the panel. An interesting section of the exhibit was devoted to the Igranic-Pacent" "Phonovox" pick-up and amplifiers for the electrical reproduction of gramophone records; two turntables are incorporated so as to shorten the time interval needed for changing records, and the large "Celestion" loud-speaker employed should be adequate for dance halls, kinematograph theatres, and such-like uses.

Other stands on which radio apparatus was seen were those of the Edison Swan Electric Co., Ltd., Marconiphone Co., Ltd., Marconi's Wireless Telegraph Co., Ltd., M.O. Valve Co., Ltd., Mullard Radio Valve Co., Ltd., and the Radio Communication Co., Ltd.

Evershed & Vignoles, Ltd.

This display consisted of improvements and further adaptations of equipment previously described. The Midworth distant repeater has been developed considerably since the last exhibition at which the first form was shown: several types were on view, including a transmitting wattmeter, so arranged that it can be dismounted for examination, similar to one being supplied for a large British power station; there was also a manually operated transmitter controlling a distant indicators, including a power-driven receiver with a 20-in. dial, arranged to repeat the exhibition voltage, the available power being indicated by the fact that the pointer will move to its position in spite of a weight placed so as to impede its movement.

An indicating "Dionic" water tester recently developed operates on the same principle as the earlier pattern, but has been greatly simplified, made less bulky, and is more convenient in every way; it can be used either permanently mounted on a panel, on a bench, or suspended in a vat or tank. A recording instrument, as used in the Barking power station, was also shown.

Bellingham & Stanley, Ltd.

On this company's stand was noticed a compact arc lamp without moving parts, which is so small that it can be used conveniently in situations where a larger lamp would be impossible. Its overall dimensions when using electrodes 3 in. long are: Height to top of electrodes, 3.5 in., width 2.75 in., depth 2.25 in. The special alloy electrodes prevent the arc wandering and burn away very slowly; the electrodes are parallel, and the arc is started by momentarily "shorting" them with a metal rod in an insulating handle. The lamp is made to slide vertically on a rod and horizontal adjustment can be provided if required. The claim that the spectrum of the alloy-electrode arc is rich in ultra-violet light has been utilised to form the "Uvir" lamp by mounting a "candle" arc, such as that described above, in front of a heat radiator, thus providing both u.v. and infra-red radiation simultaneously. The radiator also forms the resistance of the arc, so that no other apparatus is required, the whole resembling an electric bowl fire; consuming 3 A, it can be plugged into any source of d.c.

Weston Electrical Instrument Co., Ltd.

Amongst the measuring instruments displayed by this company were portable testing sets for radio service; for instance, model 519A was designed to enable very complete tests to be made upon a radio set under actual service conditions, and it should prove invaluable to all "Service" engineers. The ease with which the various voltage adjustments can be made, and any faulty valves, or circuits, detected, will appeal to those who wish to obtain the best results, whilst a bi-polar switch enables the following ranges to be selected:—200 V, resistance 200,000 ohms for measuring h.t. voltage; 20 V, resistance 20,000 ohms for measuring g.b. voltage; 8 V, resistance 8,000 ohms for measuring l.t. voltage. For all these ranges the voltmeter requires only 1 mA for full-scale deflection, and therefore can be used for sets equipped with battery eliminators. For current measurements: 400 mA for the filament current and 20 mA for the plate current of valves. To operate it a valve is removed from the radio set and inserted in the socket of the tester and a lead plugged into the empty valve socket; the above measurements can then be made for the valve in the tester, and each valve tested in succession, or its characteristics compared apart from any radio set. In addition, separate binding posts and leads are provided so that the tester can be used as a double-range voltmeter for batteries, or a double-range milliammeter of low resistance for either a range of up to 20 or 400 mA.

Philips Lamps, Ltd.

The F-type, 200-kV "Metalix" X-ray tube is intended for deep therapy and radio-metallography; it has a maximum continuous rating of 800 watts, and embodies its own protection, cooling of the anti-cathode being effected by means of a thermo-siphon attachment. Type B is provided with a patented conically bored focus in which the electrons are projected into the interior of a small hole in the face of the target, resulting in a very large focus area, whilst the effective diameter of the focus is the apex of the cone; this feature is only rendered possible by reason of the fact that the tube is of cylindrical form; X-radiation emerges from a special window at the end of the tube. Type D is provided with a "line" focus" (Goëtze patent), and it is also cylindrical, but the beam emerges at right angles to the axis of the tube, the window being arranged half-way along its length. Demountable X-ray tubes for spectrometry, &c., are so designed as to permit the easy insertion of anti-cathodes of different atomic numbers: the body of each tube is composed of a chamber of chromium iron, which alloy possesses the same coefficient of expansion as glass, and so permits of a direct glass to metal seal which is vacuum tight, X-radiation being thus generated entirely within a metal chamber. A screwed union is provided for the pump, whilst the anti-cathode can be removed by unscrewing a nut. Joints are provided with machined metal faces, and special rubber gaskets ensure a perfectly vacuum-tight joint, and by loosening three small clamps the whole of the cathode stem may be withdrawn and the filament renewed. No cement, wax, or other material liable to destruction by heat is used in the manufacture of these tubes.

Other Exhibitors.

Other exhibitors of electrical instruments and apparatus included Messrs. R. M. Catterson Smith and K. S. Mills, Cox-Cavendish Electrical Co. (1924), Ltd., Creed & Co., Ltd., Damard Lacquer Co., Ltd., in association with Bakelite, Ltd., and Mouldensite, Ltd., W. Edwards & Co., Electroflo Meters Co., Ltd., Foster Instrument Co., Fuller Accumulator Co. (1926), Ltd., A. Gallenkamp & Co., Ltd., John J. Griffin and Sons, Ltd., and Baird & Tatlock, Ltd., Adam Hilger, Ltd., Henry Hughes & Sons, Ltd., India Rubber, Gutta Percha and Telegraph Works Co., Ltd., Isenthal & Co., Ltd., George Kent, Ltd., W. H. Pettifor, W. G. Pye & Co., Record Electrical Co., Ltd., Schall & Son, Ltd., H. Tinsley & Co., Venner Time Switches, Ltd., Watson & Sons (Electro-Medical), Ltd., and the Zenith Electric Co., Ltd.

Research and Experimental Section.

The display of exhibits in this section was contributed to by the following, amongst others:—

Mr. G. L. ADDENBROOKE demonstrated that splashes on the surface of a liquid dielectric produced by a point electrode with intermittent field are due to ions of like sign to the electrode; being strongly repelled and falling on the surface they cause indentations in it. When in sufficient number they give rise to "electric wind," but are then too numerous to be observed individually; their united pressure, however, forms a hollow in the liquid. It would appear that the tingling sensation when a brush discharge falls on the skin is due to the impinging on it of showers of these ions.

When the ions formed by a single discharge fall on a solid dielectric surface, the effects remain for a long time and can be rendered visible by dusting with litharge and sulphur; the "Stress Figures" of Swan, which were shown, are photographs of effects produced in this way.

Mr. A. M. CODD's new primary wet cell consists of a jar, from the lid of which hang carbon rods, and on the bottom of which is a flat mushroom of zinc with a wire connection. The cell is filled with a solution of ferric chloride; zinc chloride is formed near the zinc and lies at the bottom of the cell, due to its higher specific gravity, thereby protecting the zinc from further action on open circuit. For long periods of open-circuit work it may be preferable to add a small quantity of sand, pumice powder, or the like, to cover the zinc and so prevent circulation of the electrolyte disturbing the layer of zinc chloride at the bottom; a little free mercury may also be added to assist amalgamation; the sand, &c., raises the internal resistance of the cell somewhat, but prolongs its life for open-circuit work. Such a cell has an e.m.f. of 1.5 volts, and a mean p.d. on 10 ohms discharge of about 1.22 volts, until at the end of its life it reaches about 1 to 1.1 volts, when it rapidly collapses. The working voltage is thus very constant, and high in comparison to the usual Leclanché-type cell. The output is about 22 ampere-hours per pint of solution, or, say, 33 ampere-hours per pound of ferric chloride used. The cell is clean in action, and does not fur or evaporate, repeating its output with remarkably little variation, and it can be relied upon for watt-hour output.

The GENERAL ELECTRIC CO., LTD., amongst numerous interesting exhibits, showed photoelectric cells that are much more sensitive to the red end of the spectrum than any cells (depending upon the photo-electric effect) previously offered for sale; red sensitivity is produced by subjecting to the Elster-Geitel "sensitising" process a surface on which potassium has been deposited, but from which it has been driven by heat. A machine was shown for "rating" lamps, *i.e.*, for determining whether they are suited for the voltage for which they are designed; in principle similar to the machine shown last year, it depends upon "colour-matching" the lamps by means of the different frequency-sensitivity relations in sodium and rubidium photoelectric cells; the new machine is much more completely automatic and suited for factory operation.

An X-ray camera has been designed to fulfil a number of different requirements: when using a copper anode X-ray tube and cylindrical cameras, powder photographs can be taken; with a standard calcite crystal it will record X-ray spectra. The flat camera is used for determining the orientation of crystals in drawn wire, metal foils, &c., and the same camera with a tungsten or platinum anode in the tube records Laue patterns.

LAWES AGRICULTURAL TRUST (Rothamsted experimental station) showed the Odén-Keen automatic recording balance, which is a combination of electromagnet and weight-dropping devices employed to maintain a sensitive analytical balance in equilibrium to record change of weight with time. The electromagnetic control is effected by a modified Callendar recorder, the movement of the sliding contact along the wire serving to increase or decrease the current in a solenoid placed under a permanent magnet suspended from one arm of the balance; the position of the slider is controlled automatically by the movements of the balance from its equilibrium position, and the circuits are arranged so that the movement of the slider is closely proportional to the weight on the balance; the weight-time curve is recorded on a rotating drum by a pen attached to the slider. When the slider reaches the end of the slide wire, a phosphor-bronze ball of known weight is deposited on the balance, the slider returns to its zero position, and the cycle of operation recommences; a "stepped" weight-time chart is thus obtained, and a very open scale is secured on a chart of reasonable dimensions.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD. (Research Department) exhibited a model of its recently constructed laboratory. Two separate laboratories are available, each having facilities for testing up to 500,000 volts at normal frequencies, or, alternatively, by opening a large shutter in the dividing wall, the equipment may be interconnected to obtain voltages up to one million. In addition, the smaller laboratory is provided with high-frequency testing equipment, including a Tesla transformer giving voltages up to 750,000 at 100,000 frequency.

Mr. E. B. MOULLIN's new forms of high-range thermionic voltmeter need only a few microwatts for their operation. Pattern C is a pivoted multi-range instrument with a maximum reading of 120 volts and an effective resistance of two megohms. Pattern E is similar, but enables peak and mean values of an alternating potential to be measured up to a maximum of 500 volts.

The NATIONAL PHYSICAL LABORATORY'S display included an electric thermostat furnace with devices for producing steady or oscillating changes of temperature (Metallurgy Department). The original Haughton-Hanson thermostat has been modified to enable slow *changes* of temperature to be obtained by admitting a slow supply of gas into either side of the U-tube which operates the relay: the gas is generated in an electrolytic cell and the rate of change of temperature of the thermostat can be controlled by adjusting the current through the cell. The thermostat was shown controlling a second furnace, the temperature of which was made to oscillate by means of clockwork that cut in and out a resistance in the controlled furnace, while the slow cooling device superimposed a downward tendency on the temperature curve.

Dr. D. OWEN demonstrated the time of establishment of current in an inductive circuit. If a diode valve with cylindrical anode and axial filament is placed between the parallel faces of the pole-pieces of an electromagnet, with the filament perpendicular to the pole-faces, and the anode is given a positive potential v, electrons emerging from the hot filament travel in straight lines direct to the anode. If now the circuit of the electromagnet is closed a magnetic field parallel to the filament is set up, and the electronic paths become curved,

in a plane perpendicular to the filament. The value of the anode current remains unaffected, however, until the magnetic field H is raised to a certain critical value, depending on the value of V and on the dimensions of the valve. At this point the electrons just fail to reach the anode; they are bent back to the filament, and the anode current drops precipitately towards zero. If the circuit of the electromagnet is now broken, allowing the anode current to resume its maximum value, on again re-making the electromagnet circuit an appreciable interval will elapse before the sudden drop of the anode current sets in. Incidentally, if the value of H is also found, the experiment allows (as shown by A. W. Hull) of a determination of the e/m ratio of the electron, the formula being $e/m = 8v/H^2R^2$, where R = radius of anode, H = critical field, v = voltage between anode and filament.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

What is a Trade Buyer?

This question as a rule settles itself in most trades or industries; unfortunately, however, it has always been a very difficult matter for the electrical trade.

The reason of this is that the electrical trade comprises about 25 per cent. of substantial firms of manufacturers and distributors, the remaining 75 per cent. being of the "straw" variety. It is true that the "straw" classes individually are unimportant, but unfortunately they are more numerous and so as a whole make the matter much more difficult.

Trading by the "straw" classes is, as a rule, very irregularly carried out, the main point being to effect a sale and rely on luck as to whether the supplier of the goods will be paid or not.

I have always considered the definition of a trade buyer to be a person or firm who sells the particular goods as a regular means of livelihood and, to my mind, subject to a very few exceptions, this is the only class entitled to trade terms.

The exceptions I would make are such firms or concerns who are very large users of any particular goods which would form part of their equipment, such as steamship companies, railway companies, and perhaps such firms as certain well-known public caterers.

The matter is largely a question of the personal self- or-trade respect of each manufacturer or factor. If he wishes to have a regard for the general welfare of his trade or profession he will observe the proper and correct usages and customs, but if he be otherwise inclined nothing will stop him cutting prices and giving discounts to all and sundry.

The abuse of giving trade terms to all and sundry is a most difficult one to deal with, but certainly much could be done if more care and consideration were given to the subject by the trade generally, and it is this lack of cohesion, and diffidence on the part of the individual trader, which have led to the matter becoming such a trade scandal. Certainly I believe no other trade exhibits a similar state of affairs in regard to this subject.

The electrical trade has never been without this bugbear. I have a recollection of it some forty years ago and it occurred in this manner. In those early days every theatre or similar public place of entertainment needed an electrician and most of those places at that time could not afford the entire services of such a man, in fact there was not the amount of work to fully occupy such a skilled man. As a result an arrangement was usually made to engage the man part time, the balance of his time being occupied in private work. Such a man, quite rightly, obtained his supplies at trade price and he supplied the theatre or other establishment with material, lamps &c., at the trade price or possibly a trifling percentage extra.

When the time arrived when the establishment could afford a whole-time electrician they naturally expected to get the same goods at the same prices as before, and as a rule obtained these terms. And so the thing grew. What was forty years ago a special or isolated case has now become general.

The remedy to some extent is in the hands of the manufacturers. They could easily compile a black list and any supplier who was found to abuse the customs or regulations could be readily dealt with by a refusal to supply further goods.

This would require a certain amount of courage and unselfishness on the part of the manufacturer, and the measure of this could probably be gauged by the prevalence of the custom to which your editorial article is directed.

If factors or manufacturers would agree to a very strict basis of quantity supply for border line cases I think a partial solution would be found for the difficulty, but even then it would need to be left to the business honour of the particular manufacturer or factor.

The matter is rendered more difficult or complex by the fact that most of the smaller supplies, such as accessories, cable, &c., can be purchased of foreign manufacture and on the suppliers of these classes of goods no particular hold can be obtained.

January 23rd, 1928. **Pioneer.**

Neutralising Resistance in an Electrical Circuit.

I have recently been giving some attention to different methods by which an electrical circuit may be made to appear to have a negative or zero resistance.

It is well known that this effect may be produced with a thermionic valve, by coupling the plate circuit back to the grid-circuit by means of condensers or inductances.

It is intended in this letter to suggest:—

(i) That back-coupling either magnetically or with capacity is unsound if it is desired to get rid of the effect of resistance, as, for instance, in an aerial circuit. Such a form of reaction multiplies up distortion caused by resistance effects, a wave-form being regenerated which is not a replica of the original wave-form.

(ii) That back-coupling by adding a voltage which is proportional to the current flowing in a circuit is much more satisfactory. The resistance drop in a circuit is proportional to the voltage across a non-inductive resistance in the circuit, and it is possible to amplify such a voltage and apply it to our circuit in such a way that the effective resistance is practically zero.

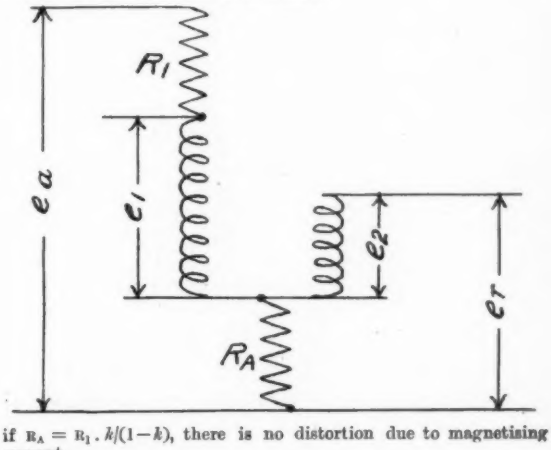
The great advantage of this form of "reaction" which the writer proposes to introduce, is that heterodyning is largely eliminated, a voltage wave being added which accurately supplies that which is lost owing to the resistance drop. The wave is not split up into different frequencies, but is by this means preserved in its original form.

It is not desired here to enter into further detail; it is sufficient to say that the method applies to speeding-up long cable services, as well as increasing the selectivity of wireless receivers and the accuracy of transmissions.

As a practical example, we may consider a step-down transformer. Assuming no current to be taken on the secondary side, by the addition of a resistance which is common to both circuits, we may obtain on the secondary side a wave form which is an exact replica of the primary wave-form (if we may neglect capacity effects). For certain purposes such a circuit which is independent of frequency has great value, either as an intervalve transformer, or in an instrument for measuring inductances.

The mathematical proof of this is given below, and the writer would be pleased to give further particulars to any who are interested.

On the transformer shown below,



if $R_A = R_1 \cdot k/(1-k)$, there is no distortion due to magnetising current.

e_r = received e.m.f. (instantaneous).

e_a = applied e.m.f. (instantaneous).

e_1 = e.m.f. at the terminals of the equivalent primary winding after resistance has been eliminated.

R_1 = the resistance of the primary winding plus that of the primary circuit between the points at which e_a is applied.

e_2 is the e.m.f. at the terminals of the secondary winding.

R_A is the added resistance.

k is the ratio of transformation, less than 1.

i_1 is the primary instantaneous current.

Thus we have, considering instantaneous values:—

$$e_1 = e_a - i_1 R_1 - i_1 R_a \quad (1)$$

$$e_2 = k \cdot e_1 \quad (2)$$

$$e_r = e_2 + i_1 R_A \quad (3)$$

$$= k \cdot e_1 + i_1 R_A \text{ from (2)}$$

$$= k \cdot (e_a - i_1 R_1 - i_1 R_a) + i_1 R_A \text{ from (1)}$$

and $e_r = k \cdot e_a$ at every instant if $k(R_1 + R_a) = R_A$

i.e., if $R_A = R_1 \cdot k/(1-k)$, and e_r is independent of the magnetising current, no matter what the wave-form of the latter may be. Even if a small load is taken on the secondary side, still the iron in the circuit will have no distorting effect; the primary and secondary leakage reactance, and the extra resistance will cause voltage drops, so this form of potential transformer has its disadvantages. Where, however, the secondary load is negligible (or even then, if the impedance of the load is constant), such a form of coupling, where $e_r = ke_a$ always, might, conceivably, be extremely useful. In this letter, it serves to demonstrate the possibility and advantages of the first methods suggested.

Rugby, *January 25th*, 1928. **W. E. Bruges.**

Rebuilding Shafts by Electric Welding.

With reference to the letter from "Inquirer" in your issue of January 13th, may we point out that for re-building armature shafts the "Fescol" process has long been standard throughout the country. The process, which is a cold one and occasions, therefore, no risk of distortion or injury to the windings, consists of the electrochemical deposition of pure nickel on the worn part, which is then machined back to standard. It has been found that shafts so rebuilt with nickel have given a considerably longer life, even up to four or five times that of the original steel.

If your correspondent will communicate with us we shall be very pleased to give him full particulars of our process, and if he would care to visit our works (by appointment) he could then see the process in operation on these and similar parts and satisfy himself that "Fescol"-ising these shafts would entirely obviate the difficulty of which he writes.

Fescol, Ltd.
J. NICHOLSON-SMITH, *Managing Director.*
London, *January 26th*, 1928.

Electrical Contractors, I.E.E. Rules, and Fire-Insurance Companies.

I wonder whether the following queries would be sufficiently interesting to warrant this letter appearing in your "Correspondence" columns?

1. I installed electric light in a residence over a year ago, and in a questionnaire issued by my client's insurance company I certified that the work complied with I.E.E. rules, honestly thinking at the time that such was the case. My tender also included a similar undertaking. They issued a policy. I now find that the work deviates from the rules in a rather important particular, and my client has also found this out.
   (a) Can he make me alter it without charge until it complies with the rules?
   (b) Can he get someone else to make the alterations, and send me the bill?
   (c) If the premises are burned down prior to the work having been altered to comply, can the insurance company refuse to pay up?
   (d) Can I be held financially responsible in the event of such fire by either the owner of the premises or the insurance company? If so, to what extent?
2. Conditions as before, *but I replied to no questionnaire and signed no certificate.*
3. Speaking generally, when an insurance company accepts a fire risk is it expected to make all necessary inquiries itself and then to refuse or accept the risk absolutely? In a case where it has not been prevented from inspecting and testing the work in progress and after completion, can it shift responsibility by saying that a comprehensive and variously applied collection of rules has been transgressed (a) unintentionally, (b) intentionally?

Charles E. Hancock.
Sparkford, *January 26th*, 1928.

[Our impression is that the answers in the first case are generally in the affirmative (but *b* would not apply unless a remedy was not found under *a*), and in the second case in the negative. As for the third case, it is a matter between the insurance company and the client, depending upon the terms of the policy. If the contractor has not undertaken to comply with the I.E.E. "Regulations," which have no legal authority, he cannot be held liable for non-compliance. These are our own views; we should welcome the opinions of correspondents.

In practice, insurance companies do not usually inspect installations, nor do they repudiate liability on the ground that the wiring was not done in accordance with regulations.—EDS. ELEC. REV.]

Electrical Accessories: Delayed Deliveries.

I shall be glad if, through the medium of your paper, it can be made possible to obtain better service of electrical accessories supplies.

As customers' requirements vary considerably according to individual tastes, a small firm, not being in a position to hold extensive stocks, resorts to keeping a fairly comprehensive selection covering a range which the management considers will meet his clientèle. To his horror he finds that, a particular selection being made, it is not possible to obtain delivery of an order of any reasonable quantity, without undue delay, which naturally leads to complications, very often unpleasant and detrimental from a business point of view, with the customer.

A question, very similar perhaps, arises when quoting for a tender. Prices in most cases are taken from firms' price lists, in accordance with the specifications, and as there is a certain lapse of time, one is afraid to think, if his tender is accepted, whether his position will be on the debit or credit side when the work is completed.

Perhaps some of your readers will very kindly enlighten me how best to deal with the situation.

H. D. B. Montgomery.
London, *January 18th*, 1928.

Lee's Book on Electric Mains.

In 1903, Mr. L. R. Lee, the mains engineer (then and now) of the Manchester Corporation, wrote a book entitled "Practical Notes on Electric Mains," which was published by Biggs and Co., and in which some remarkable prophecies were made as to the future design of cables.

It would be very interesting to most people connected with mains to see a copy of this book, but no one that I know has a copy, having, like Mr. Lee and myself, lent our own copies, and having reaped the usual reward of book-lending!

If any of your readers have a copy to sell, or know where a copy is to be obtained, will they kindly communicate with me, and their reward will be great (to be precise, up to 500 per cent. of the original value of the book)?

J. H. C. Brooking,
Managing Director,
GREENWICH CABLE WORKS, LTD.
London, *January 21st* 1928.

Radiological Apparatus.

The three letters from your correspondents in your issue of the 20th inst. are welcome. Criticism was expected, and there are a few points on which there is still a difference of opinion. On the whole, most of the article seems to be agreed upon. The question of wooden *versus* metal cases is not settled, and apparently time alone will show which is preferable. As some manufacturers do use all-metal containers, it is not correct to say that our advocacy of metal cabinets is universally considered wrong. The increase of the practice of running power plant in a separate room is certainly all to the good, as Mr. Gough points out. The Metalix tube being a form of Coolidge tube, it was not mentioned in detail, although its use certainly is on the increase. However, we had rather a shock at Mr. Pullen's lecture to the Physical Society on January 11th, when a slide was shown of a radiograph of a Metalix tube. The tube was by no means opaque, although in the radiograph twice the thickness of metal had been penetrated!

Mr. Gough remarks that we do not appear to be in closest touch with X-ray manufacture. This is so, and on the principle that the looker-on sees most of the game the resultant opinion that was formed was unbiased, and no particular maker's apparatus was boosted.

Regarding instruments, it is a fact that most of the apparatus shown had foreign instruments. The apparatus mentioned by Mr. Gough as having British instruments was one of the exceptions, and we were aware of this.

On gas tubes, we are aware that the use of the Coolidge is increasing, hence our surprise at finding such a quantity of gas tubes on show. The direct-reading kilovoltmeter mentioned is the Abraham type, made by Messrs. Everett, Edgcumbe and Co., for 200 kilovolts. As mentioned in the article, this is usually impracticable, but possible. Another method is to use a high-voltage air condenser across the mains. In series is a double rectifier, back to back, with a d.c. milliammeter in series with one of them. The mean rectified current (half of which is read on the instrument) is proportional to the peak voltage, which is what is required. The condenser may be a standard sphere-gap, set at a greater gap than can be sparked over by the highest voltage used.

Some people are not yet convinced that running a thermionic valve filament at constant voltage is preferable to running at constant current. This is a point well worth emphasising, as the life of valves (either rectifiers or large radio-transmitting valves) is of great economic importance.

One statement in the article was rather loosely worded, but it has not been commented on. By "emission is proportional to the temperature, not to the current," was meant that if a filament is run throughout life at constant temperature its emission will be nearly constant, but if the current is maintained constant throughout life the emission will rise rapidly at the end of life, and this increase is due to the higher temperature which appreciably shortens the life. Running at constant voltage results, in practice, in a slightly decreasing emission, so that the voltage should be raised slightly towards the end of life. The fact remains, and we have ample data as to its truth, that with constant voltage the life of an average valve will be about *four times* that of one running at constant current. Again, Mr. Gough's firm is one of the few showing voltmeters instead of ammeters, and the practice is most strongly to be recommended.

The statement that modern X-ray apparatus is scientifically designed is true of the best apparatus, but on some points a number of manufacturers' apparatus are not scientifically designed, the point about the use of filament ammeters being one of the most prominent.

On the score of protection from the high voltage, the only mention of this by your correspondents is by one who does consider this, and installs red warning lamps and other devices. This also is to be commended to other manufacturers.

If this ventilation of the case of the engineering aspect of radiological apparatus results in all manufacturers improving their standard to that of the best among them, the article will have achieved its object.

The Author of the Article.
London, *January 23rd*, 1928.

Legal.

Burndept Wireless, Ltd.

MR. JUSTICE ROMER, in the Winding-up Court on January 30th, heard the petition of Colonel Eric Ball for an order for the compulsory liquidation of Burndept Wireless, Ltd.

Mr. CLAYTON, K.C., for the petitioner, said he was a judgment creditor for £2,096, damages for wrongful dismissal from his position as chief sales manager. There were a number of opposing creditors. The two principal creditors opposing the petition were Messrs. Johnson & Phillips, Ltd., and the Crown. The former were creditors for £64,813, and of that £56,000 was secured by a debenture for cash on condition that £25,108 unsecured debt should be paid out of the money advanced. The Crown was creditor for £20,788, said to be for income and corporation profits tax. The latter tax was abolished before the company was incorporated, and as to the former, the company since it began had done nothing but lose money, so it was a little difficult to understand how the money was due. The company was incorporated in March, 1925, and down to June 28th, 1927, it had lost £216,548. That was according to the company's own figures, but in fact the losses were much greater because the figures made no allowance for claims for damages for alleged wrongful dismissal and other alleged breaches of contract in trading. Besides the petitioner, there were a number of other employés wrongfully dismissed, and nothing was put down for them. On the assets side of the balance-sheet was a figure of £25,883 for preliminary expenses which was represented by no tangible assets.

The petition was being opposed on the ground that the receiver for the first debenture holders (Coutts's Bank) had carried on business for six months at a profit of £2,486, a profit which he submitted was wholly fictitious.

Both Mr. SWORDS (representing the Crown), Mr. BISCHOFF (other creditors), and Mr. GAVIN SIMONDS, K.C. (the company) said if the company was wound up valuable rights would be lost, while a majority of the creditors thought they would be better off if the business was continued by the receiver.

His LORDSHIP said, in the face of the opinions that had been expressed, he must dismiss the petition with costs.

Marconi International Code Co., Ltd.

MR. JUSTICE ROMER, in the Chancery Division on January 30th, heard the petition of the Marconi International Code Co., Ltd., for sanction to the reduction of its capital from £50,000 to £2,500 by writing 19s. off each £1 share.

Mr. GAVIN SIMONDS, K.C., for the company, said that Marconi's Wireless Telegraph Co., Ltd., was the principal shareholder, and there was a debit in the company's account of some £81,000 owing to that company, which had, however, agreed to forgive £39,000 of it.

His LORDSHIP sanctioned the reduction.

A Medical Electrician Convicted.

ON Monday last week, at the Central Criminal Court, before the Lord Chief Justice, Charles Jackson Palmer, described as a "medical electrician," was charged with the manslaughter of Elsie Alice Goldsmith, to whom he had given electrical treatment for nervous debility on November 21st, 1927. According to the defendant, the deceased died suddenly whilst under treatment; no other person was present at the time. The treatment was given by passing an alternating current through the body in the abdominal region. Mr. Gough, Graduate I.E.E., gave evidence that the current from the electrical apparatus used could not be strong enough to cause death or a serious burn or shock. The medical evidence indicated that death was due to syncope and shock following on an injection of liquid. The defendant stated that he had studied medical electricity since 1898, and held a licence from the London County Council.

On Friday the case was concluded, the jury finding that the woman's death followed an illegal operation. On Tuesday a sentence of seven years' penal servitude was pronounced, the defendant to pay the costs of the prosecution.

Proposed Sub-Station in a Churchyard.

IN the Court of Arches, on January 24th, the Dean of Arches (Sir Lewis Dibdin) dismissed an appeal from a decision of the Chancellor of the Diocese of London. The latter refused to sanction an agreement between the rector and wardens of St. Nicholas Acons and the City of London Electric Lighting Co., Ltd., whereby the company was to be permitted to extend an existing transformer chamber into a churchyard. The London County Council intervened on the ground that the proposed work would be an infringement of the Disused Burial Grounds Act.

Theft of Electricity.

AT Ammanford, South Wales, Police Court on January 23rd, Fred Gregory, Bettws, was charged with the fraudulent consumption of electricity from the mains of the Ammanford Urban District Council. It was stated for the prosecution that the supply was cut off from the defendant's house early in 1926 owing to the non-payment of an account. An official from the electricity works later discovered that electric lighting was being used by the defendant, and it was found that the wires had been unsealed and re-connected. A fine of four guineas, with one guinea costs, was imposed.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1926.

17,257. "Electromagnetic belts." G. Wilshire. July 9th, 1926. (283,236.)
19,375. "Thermostatically-controlled switch devices." Siemens Bros. & Co., Ltd., and E. R. Garrod. August 5th, 1926. (283,239.)
19,639. "Secondary batteries or accumulators." P. M. Woodhouse. May 2nd, 1927. (283,241.)
24,099. "Electro-mechanically-controlled telephone systems and switching-apparatus therefor." H. Baron (F. Aldendorff). September 29th, 1926. (283,252.)
24,366. "Electromagnetic testing of wire ropes." T. F. Wall. October 1st, 1926. (Cognate application 14,462/27.) (283,256.)
24,674. "Radio transmission systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). October 5th, 1926. (283,264.)
24,710. "Electric switches." G. R. Brown. October 5th, 1926. (283,268.)
24,960. "Dynamo-electric machines." Sir C. A. Parsons and J. Rosen. October 7th, 1926. (283,282.)
25,069. "Sound-reproducing devices." M. E. Newland. October 8th, 1926. (Cognate application 3,453/27.) (283,286.)
25,143. "Electrodeposition of metals." H. Webb and S. O'Brien and Partners, Ltd. October 9th, 1926. (283,288.)
25,268. "Electric pattern mechanism for lifting the needles in circular knitting-machines." F. H. Rogers (Chemnitzer Strickmaschinen-Fabrik). October 11th, 1926. (283,291.)
25,289. "Suspension device, more particularly for overhead lamps or pendant light fittings." British Thomson Houston Co., Ltd., and F. M. Cocksedge. October 11th, 1926. (283,292.)
26,628. "Electric inductor coils." G. E. Taylor and Electric Furnace Co., Ltd. October 25th, 1926. (283,302.)
27,109. "Lighting systems and apparatus for motor and other road vehicles." E. W. Davies October 29th, 1926. (283,306.)
28,315. "Electrical connecting devices." A. Bray and G. Bray & Co., Ltd. November 10th, 1926. (Cognate application 7,355/27.) (283,309.)
28,370. "Multiple-amplifier electric discharge devices." Dr. S. Loewe. November 12th, 1925. (261,391.)
28,890. "Starting circuit for the line-finders of automatic telephone exchanges." H. Baron (F. Aldendorff). November 16th, 1926. (283,310.)
29,363. "Electrical heating elements." Santon, Ltd., and H. C. Sanders. November 20th, 1926. (283,312.)
32,113. "Generation of power by the use of tidal energy." R. Pennington and Mather & Platt, Ltd. December 18th, 1926. (283,327.)
32,924. "Pocket electric signalling lamp." H. Birkbeck (Electrotechnische Fabrik Schmidt & Co., Ges.). December 30th, 1926. (283,337.)

1927.

3,676. "Alloy having a high electrical resistance." Y. Kamishima. February 9th, 1927. (283,354.)
6,510. "Multiple thermionic valves." Loewe-Audion Ges. March 8th, 1926. (267,168.)
9,147. "Electric accumulators." G. Fromont. April 2nd, 1926. (Addition to 250,985.) (268,828.)
9,629. "Inductor-type alternating-current electric generator." F. Newton. April 7th, 1927. (283,377.)
9,809. "Electric circuit interrupters." G. S. Lane. April 9th, 1927. (283,378.)
10,357. "Dynamo-electric machines." F. Kesselring. April 15th, 1926. (269,589.)
10,474. "Head light controls for motor vehicles." A. T. Munch. April 19th, 1927. (283,382.)
10,603. "Electric heating of travelling material." Ajax Electrothermic Corporation. October 29th, 1926. (279,779.)
10,772. "Electric lamp fittings." Cable Accessories Co., Ltd., and F. H. Reeves. April 22nd, 1927. (283,385.)
11,687. "Electrotherapeutic appliances." Y. Noishiki. May 2nd, 1927. (283,390.)
11,813. "Variable condenser." S. Dunlop (Federal Telegraph Co.). May 3rd, 1927. (283,391.)
13,802. "Armature-actuating mechanism for magnetos." E. C. R. Marks (Wico Electric Co.). May 23rd, 1927. (283,400.)
14,711. "Electrical pole-finders." J. G. Lyall. June 1st, 1927. (283,404.)
15,096. "Masts for supporting high-tension electric cables." F. Berg. June 7th, 1927. (283,406.)
15,099. "Supporting means for medium voltage electric cables." F. Berg. June 7th, 1927. (283,407.)
15,104. "Clamps for high-tension electric cables." F. Berg. June 7th, 1927. (283,408.)
15,445. "Electrical coursing or race-tracks and apparatus therefor." E. L. Price and E. R. Elliston. June 9th, 1927. (283,410.)
15,684. "Electric induction meters and relays." British Thomson-Houston Co., Ltd. June 29th, 1926. (273,680.)
16,573. "Cables." H. Spanne and B. S. F. Ell. June 22nd, 1927. (283,417.)
17,286. "Protective apparatus for electric circuits." British Thomson-Houston Co., Ltd. July 9th, 1926. (274,076.)
17,475. "Vehicle headlight controls." A. Laribe. July 8th, 1926. (274,073.)
19,149. "Commutator windings for dynamo-electric machines." International General Electric Co., Inc. July 20th, 1926. (274,869.)
19,498. "Photometric apparatus." British Thomson Houston Co., Ltd. August 9th, 1926. (275,597.)
19,529. "Process for the production by electrolysis of thin superposed nickel sheets and for separating them one from another." E. Breuning and O. Schneider. July 27th, 1926. (275,221.)
20,055. "Protective device for electrical circuits." A. Schuhan. February 18th, 1927. (283,430.)
20,875. "Electrically-illuminated writing implement." F. Lochmann. August 8th, 1927. (283,432.)
22,005. "Electric cooking-stoves." C. C. Armstrong. August 3rd, 1925. (Divided application on 256,256.) (276,363.)
22,782. "Potentiometric devices." Allgemeine Elektricitats-Ges. September 14th, 1926. (277,645.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections to any of the proposed marks may be entered within one month from January 25th :—

Eagle (lettering and design). No. 476,521. Class 8. Thermionic valves for use in radio-telephony and telegraphy.—A. Fuchs, Vienna, and 21, Brunswick Square, W.C.1.

Advance. No. 485,812. Class 8. Instruments and apparatus and parts thereof for use in radio telephony.—G. Foster, 9a, Barton Street, Barons Court Road, W.14.

Concophone. No. 486,344. Class 8. Radio-telephonic loud speakers.—Concophone Co., 13a, Alexander Road, Gipsy Hill, S.E.19.

Mulchro. No. 486,538. Class 8. Philosophical and scientific instruments, &c.—Houghton-Butcher Manufacturing Co., Ltd., Fulbourne Road, Walthamstow, E.17.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ACOMB (YORKS.).—Housing scheme (46), for Great Ouseburn R.D.C.; H. C. Paine, surveyor, Green Hammerton, Yorks.

ASHFORD (KENT).—Telephone exchange, for H.M. Office of Works; Elmore & Son, builders, Maidstone.

BANBURY.—Secondary school (£26,000), for Oxfordshire E.C.; Director of Education, Oxford.

BATLEY.—Workshops for blind; Dewsbury Corporation and West Riding C.C.

BEXHILL.—Houses, Collington Lane, Cooden Drive, Plemont Gardens, and Terminus Avenue; J. E. Maynard, Collington Avenue. 50 houses, Sidley Estate; borough engineer.

BIRMINGHAM.—Wesleyan Church, Ibstock (£6,000); trustees. Schools, Dolphin Lane and Hartfield Lane, Acock's Green; chief education official, Education Department.

BLOXWICH (WALSALL).—Works, Revival Street, for J. & J. Wiggin, Ltd. (over £10,000).

BOSTON.—Additional 20 houses for the T.C.; D. G. Cockrill, borough surveyor.

BRIGHTON.—Improvements, Preston Park (£18,500); borough engineer.

BURSLEM.—Catholic Church, school, parish hall, and presbytery, High Street; Rev. J. O'Connor.

BURTON-ON-TRENT.—Business stores (£16,000), for the Co-operative Society; secretary.

BURY (LANCS.).—Additional 120 houses, St. Stephen's Estate, for the T.C.; borough surveyor.

CANTERBURY.—Hospital (£100,000), for the governors of Kent and Canterbury Hospital; secretary.

CHELMSFORD.—Fire alarm system; borough engineer. Offices, library buildings, Market Road; Essex Education Committee.

CHORLEY.—50 houses, Marlborough Estate; borough engineer. Gasworks extensions (£62,500); gas engineer.

CLECKHEATON.—School, South Parade, for Spenborough E.C.; John H. Linfield, clerk.

CRESWELL (STAFFORD).—Institution for mental defectives for Staffs C.C.; clerk, Stafford.

DORKING.—Clinic and tuberculosis dispensary; Surrey Education Committee.

DUDLEY.—Primitive Methodist Church (£2,500); trustees. School, for the Borough E.C.; J. Brock Allon, clerk.

EASTLEIGH.—Secondary school; Hampshire Education Committee.

ELLESMERE PORT AND WHITBY.—Maternity and child welfare centre for the U.D.C.; surveyor.

FALKIRK.—Reconstruction of Portdownie Iron Works (£30,000) for Walker, Hunter & Co., Ltd.; Blyth and Blyth, consulting engineers, George Street, Edinburgh.

FARNHAM ROYAL (BUCKS.).—Houses (262), Farnham Road, for Gradwell & Co., Ltd. Factory, Farnham Road, Slough Estates, Ltd.

FEATHERSTONE.—Middle school; West Riding Education Committee.

FOLKESTONE.—Greyhound racing track, for the Folkestone Greyhound Racing, Ltd., 5, John Street, Bedford Row, W.C.

GLASGOW.—Houses (412) for Corporation; director of housing.

GLOSSOP.—Reconstruction, Theatre Royal; lessee.

GRAVESEND.—Improved lighting, Town Hall; borough electrical engineer.

HENDON.—Trade and technical school, The Hyde; Middlesex Education Committee.

HUCKNALL.—Cinema, for the proprietors of the Hucknall Empire.

HULL.—Congregational Church, James Reckitt Avenue; trustees.

HURLFORD.—Additional 32 houses for Ayrshire E.C.; Thomas C. Stewart, Clydesdale Bank Buildings, Kilmarnock.

IRISH FREE STATE (ARDEE, CO. LOUTH).—Waterworks scheme (£12,700); County Board of Health.

(CASTLEBAR, CO. MAYO).—Electric lighting at the Military Barracks for the Commissioners of Public Works, Dublin.

(DUBLIN).—Electric lighting in the Four Courts, for the Commissioners of Public Works.

KEIGHLEY.—New buildings, Drake & Tonson's secondary schools; governors.

KIDDERMINSTER.—Domestic subjects centre, Castle Road; J. Hawcroft, borough engineer.

KINGSTON.—New Tiffin Boys' school; Surrey Education Committee.

KIRBYMOORSIDE.—Kitchen, &c., at Yorkshire Children's Orthopædic Hospital; J. R. White, architect, County Hall, Northallerton.

LANARKSHIRE.—Manse for Livingstone Memorial U.F. Church, Blantyre (£1,700); the minister.

LONDON.—Hotels, shops, flats, warehouses, &c.; Grand Junction Canal Co., 21, Surrey Street, W.C.2. Underground goods railway; London Goods Railway, Ltd.

(HACKNEY, E.).—20 shops, Rodley Road; A. Tate. Factory, 5 & 7, Wellington Road; A. J. King, Ltd. Warehouse and office, 73-75, Shacklewell Lane; Woodward & Co.

(LEYTON, E.).—Extensions, electricity works, for the T.C.; J. H. Jacques, architect, 61, West Ham Lane, Stratford, E.

(WEST HAM, E.).—Extensions, Upton Cross schools (£10,054), and South Hallsville schools (£14,500), for the borough E.C.; G. E. Hilleary, clerk.

(BATTERSEA, S.W.).—Three shops, Battersea Bridge Road; J. Vernoevan.

(CAMBERWELL, S.E.).—Dwellings, Comber Estate; L.C.C.

(CLAPHAM, S.W.).—11 houses, Queensville Road; F. H. Hooper. Extensions, Queenswood Court, King's Avenue; H. P. Sanders.

(FULHAM, S.W.).—Garage, showroom, and offices, Fulham Palace Road and Rosedew Road; Sinclair Automobiles, Ltd.

(SOUTHFIELDS, S.W.).—18 flats, Merton Road; E. Clarke and Sons.

(WANDSWORTH, S.W.).—1,000 flats; Special Committee of Borough Council.

MANCHESTER.—Housing scheme (350), Blackley Estate; Housing Director, Town Hall.

MERTHYR.—Depot, Old Brewery site, Gellifaelog; borough engineer. 20 houses, Gellifaelog; borough engineer.

NORTHAMPTON.—Additions at the County Offices (£20,000); Talbot, Brown & Fisher, architects, Burystead Place, Wellingborough.

NORTHERN IRELAND (BELFAST).—Maternity Department, Royal Victoria Hospital (£100,000), for the board of management.

PRESTON.—Extensions, borough hospital, dock offices, and municipal offices (£8,500), for the T.C.; borough surveyor.

PURBROOK.—Elementary school; Hampshire Education Committee.

PURLEY.—Dispensary and clinic; Surrey Education Committee.

READING.—Greyhound racing track, Caversham, for Greyhound Racing Association (Berkshire), Ltd.

SEVENOAKS.—Re-erection after fire of Greatness Flour Mill (electrically equipped, £14,000), for George Bennett Platt, Borough Green, Wrotham.

SHOEBURYNESS.—Development of Thorpedene Estate for houses, with electrical work, for H. Martin, Victoria Street, London, S.W.

SNODLAND.—Central schools (£25,940), for Kent E.C.; Director of Education, Sessions House, Maidstone.

SOUTHEND-ON-SEA.—Church, Wick Estate, for St. Augustine's Church, Thorpe Bay; incumbent. Extensive alterations, 111, Hamlet Court Road, for Craddocks (Westcliff), Ltd.

STOKE-ON-TRENT.—Sewage works (£177,000); city engineer.

STORRINGTON (SUSSEX).—Post office and telephone exchange for H.M. Office of Works, King Charles Street, London, S.W.

TYNEMOUTH.—Garage, Hawkeys Lane; Coast Road Motor Co.

ULVERSTON.—Central School at Haverthwaite, for Lancashire County Education Committee; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

WALKDEN.—Clinic and welfare centre; Lancashire Education Committee.

WAREHAM.—Electric light installation, Institution, for the B.G.; clerk.

WELLINGTON (SALOP).—Additional 64 houses, Orleton Lane estate, for the U.D.C.; surveyor.

WEMBLEY.—Secondary school, Carlton Avenue; Middlesex Education Committee.

WHERWELL.—Elementary school; Hampshire Education Committee.

WISBECH.—Alterations at the Corn Exchange and municipal buildings; borough surveyor.

WOOLSTON (SOUTHAMPTON).—Re-erection of portion of works for J. I. Thornycroft & Co.

WREXHAM.—Additional 212 houses, for the R.D.C.; surveyor.